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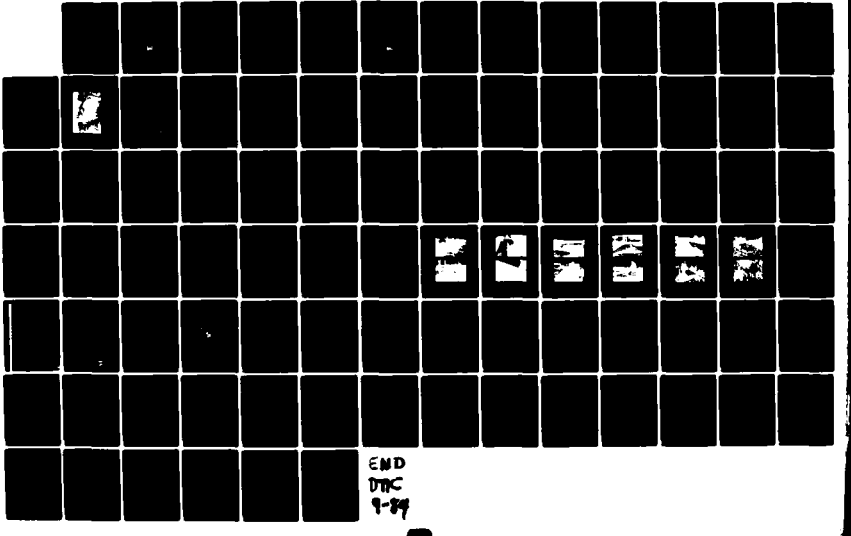

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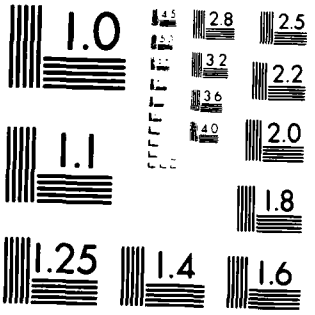

THAMES RIVER BASIN
STERLING, CONNECTICUT

STERLING POND DAM
CT 00610

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

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DECEMBER 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00610	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Sterling Pond Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE December 1980 13. NUMBER OF PAGES 65
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Thames River Basin
Sterling, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Sterling Pond Dam is a masonry structure with earth fill along the upstream slope. The dam is approximately 1010 feet in length, 12.5 feet in height and impounds approx. 125 acre-feet of water on the Moosup River. The DAM IS classified as a high hazard, small size dam. The test flood range is from ½ the PMF to the PMF. Based upon the visual inspection at the site and past performance of the dam, the project is judged to be in fair condition.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

JUL 16 1981

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Sterling Pond Dam (CT-00610) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis.

The preliminary hydrologic analysis indicated that the spillway capacity for the Sterling Pond Dam would likely be exceeded by floods greater than 5 percent of the Probable Maximum Flood (PMF). Our screening criteria specifies that a dam classified as high hazard with a spillway capacity insufficient to discharge fifty percent of the PMF be judged as having a seriously inadequate spillway. As a result, this dam is assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

We recommend that within twelve months from the date of this report the owner of the dam engage the services of a qualified registered engineer to determine further the potential of overtopping the dam and the need for and the means to increase project discharge capacity. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed and round-the-clock surveillance should be provided during periods of heavy precipitation or high project discharge.

NEDED
Honorable William A. O'Neill

I approve the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the program.

Copies of this report have been forwarded to the Department of Environmental Protection and to the owner, Kenneth Lynch & Sons, 78 Danbury Road, Wilton, CT. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Protection for your cooperation in this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

A-1

THAMES RIVER BASIN

STERLING, CONNECTICUT

STERLING POND DAM
CT 00610

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. 02154

DECEMBER 1980

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	STERLING POND DAM
Inventory Number:	CT 00610
State Located:	CONNECTICUT
County Located:	WINDHAM
Town Located:	STERLING
Stream:	MOOSUP RIVER
Owner:	KENNETH LYNCH AND SONS
Date of Inspection:	NOVEMBER 13, 1980
Inspection Team:	PETER M. HEYNEN, P.E.
	JAY A. COSTELLO
	MURALI ATLURU, P.E.

The Sterling Pond Dam, built in 1870 to impound water for industrial use, is a masonry structure with earth fill along the upstream slope. The dam is approximately 1010 feet in lengtn, 12.5 feet in height and impounds approximately 125 acre-feet of water on the Moosup River. There are three stone masonry spillways; one at each end and one at the central portion of the dam. The spillway at the left end is 65 feet long, the central spillway is 70 feet long and the right spillway is 52 feet long.

In accordance with the Army Corps of Engineers Guidelines, Sterling Pond Dam is classified as a high hazard, small size dam. The test flood range is from one-half the Probable Maximum Flood (1/2 PMF) to the Probable Maximum Flood (PMF). The test flood for Sterling Pond Dam is selected as equivalent to the 1/2 PMF. Peak inflow to the lake at the test flood is 28,400 cubic feet per second (cfs) and peak outflow is 28,000 cfs with the dam overtopped by 4.3 feet. The total capacity of all three spillways with the lake level to the top of the dam is 2940 cfs, which is 10% of routed test flood outflow.

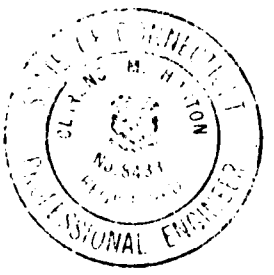
Based upon the visual inspection at the site and past performance of the dam, the project is judged to be in fair condition. There are items requiring repair, maintenance and monitoring such as deterioration of the masonry at the spillways, erosion at the top and upstream slope of the earth fill embankment, lack of riprap protection on the upstream slope and minor seepage.

It is recommended that the owner retain the services of a registered professional engineer qualified in dam design and inspection to establish corrective measures for the items presented in Section 7.2. The engineer should also perform further analysis to more accurately determine project discharge and overtopping potential. The corrective measures established by the engineer should include procedures for repair of the spillways, investigation and monitoring of seepage, removal of trees and brush from the embankment, filling holes in the top of the embankment, regrading the slopes, and providing riprap and a protective cover. Also, ownership of some sections of the dam could not be determined (See Section 1.2e). Recommendations should be made by the engineer and implemented by the owner(s).

The above recommendations and further remedial measures presented in Section 7, should be instituted within 1 (one) year of the owner(s) receipt of this report.

Peter M. Heynen, P.E.
Chief Geotechnical Engineer
Cahn Engineers, Inc.

C. Michael Horton, P.E.
Chief Engineer
Cahn Engineers, Inc.



This Phase I Inspection Report on Sterling Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH W. FINEGAN, JR., CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam would necessarily represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions there of. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as neccessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

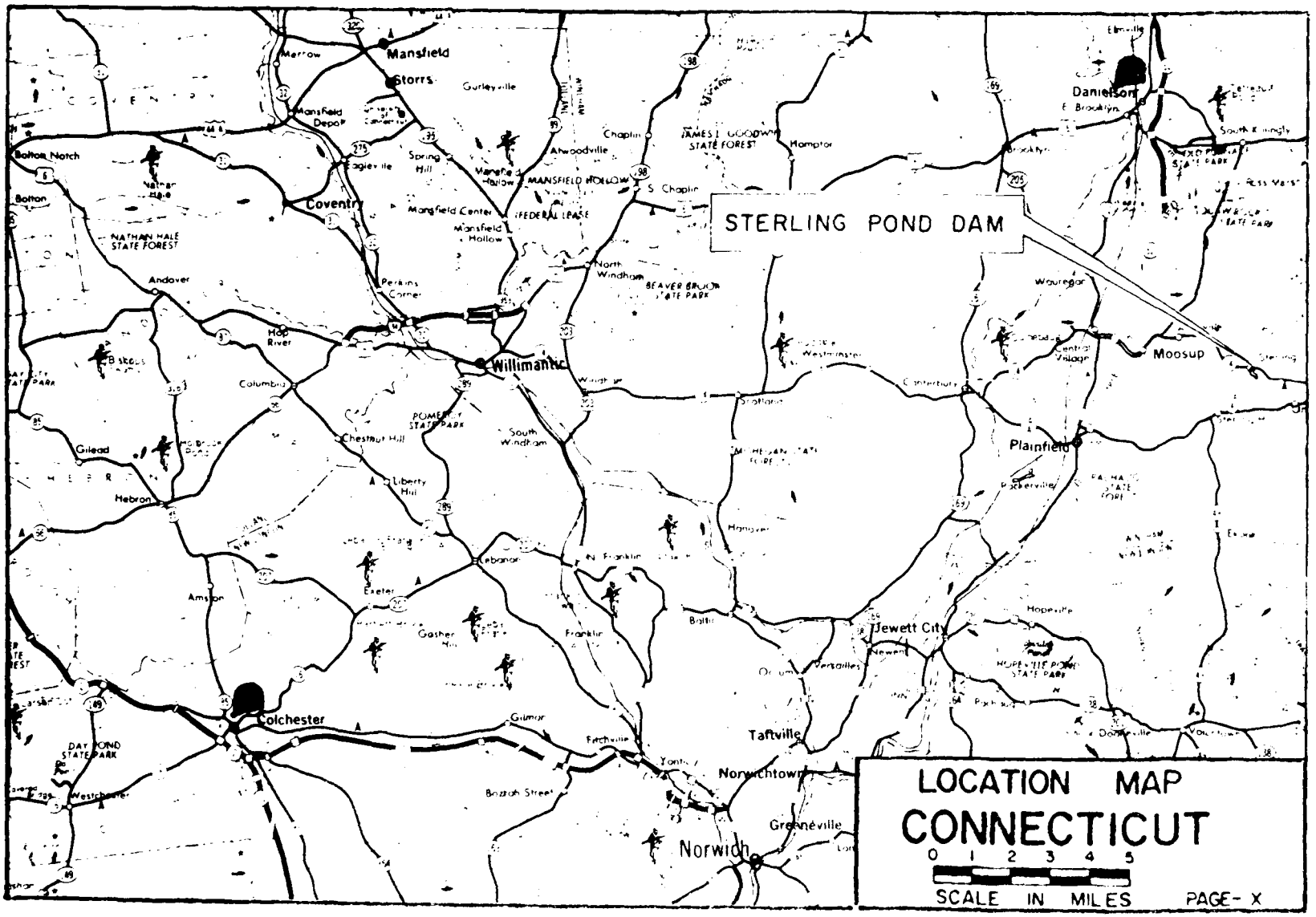
The information contained in this report is based on the limited investigation described above and is not warranted to indicate the actual condition of the dam. The integrity of the dam can only be determined by a means of a monitoring program and/or a detailed physical investigation. The accuracy of available data is assumed where not in obvious conflict with facts observable during the visual inspection.

TABLE OF CONTENTS

APPENDICES

OVERVIEW PHOTO
(February, 1980)

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS DAHN ENGINEERS INC WESTBROOK, CONN ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	Sterling Pond Dam Moosup River	Sterling CONNECTICUT	DATE Dec. 1980 CE # [illegible] PAGE [illegible]


STERLING POND DAM
Mansfield
Storrs
Coventry
Willimantic
Colchester
Norwich
Plainfield
Moosup
Jewett City
Taftville
Norwichtown
Danielson
LOCATION MAP
CONNECTICUT
0 1 2 3 4 5
SCALE IN MILES

PHASE I INSPECTION REPORT

STERLING POND DAM

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Rhode Island. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of April 14, 1980 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0052 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dam.

3. To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

1. Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

2. A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

3. Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

4. An assessment of the condition of the facility and corrective measures required.

It should be noted that this report passes judgment only on those factors of safety and stability which can be determined by a visual surface examination. The inspection is to identify those visually apparent features of the dam which evidence the need for corrective action and/or further study and investigation.

1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on the Moosup River (Thames River Basin) in a rural area in the town of Sterling, County of Windham, State of Connecticut. The dam is shown on the Oneca, Conn. - R.I. USGS Quandrangle Map, having coordinates latitude N41°42.4' and longitude W71°49.9'.

b. Description of Dam and Appurtenances - The dam consists of a stone and mortar masonry structure forming the downstream face with an earth fill embankment along the top and upstream slope (See Sheet B-1 and Overview Photo). The dam has a total length of 1010 feet, averages 12 feet wide at the top and is 12.5 feet in height. The elevation of the top of the dam varies from 308± at the left end to its lowest point, 306.3, near the right end. The upstream slope is quite irregular and the angle of inclination varies between 1.5 horizontal to 1 vertical and 3 horizontal to 1 vertical. The downstream slope is the vertical face of the stone masonry.

There are three stone and mortar masonry spillways presently in use, and one which has been filled in with concrete. The principal spillway is located at the far right end of the dam. It is 52 feet long, has a crest elevation of 303.0, 3.5 foot high stone and mortar masonry walls at each end and a 50 foot long by 8 foot high dry-laid stone masonry wall along the right side of the discharge channel (See Sheet B-1). The auxiliary spillways are located at the left end of the dam (Auxiliary Spillway Number 1) and the central part of the dam (Auxiliary Spillway Number 2). Auxiliary Spillway Number 1 is 65 feet long, has 5± foot high stone masonry walls at each end and a 7 foot high dry-laid stone wall along each side of the discharge channel. The wall at the left side of the discharge channel is about 35 feet long and the one on the right is about 55 feet long. These walls channel the spillway discharge under a bridge about 40 feet downstream at Church Street. Auxiliary Spillway Number 2 is 70 feet long with 4± foot high walls at each end and a 30 foot long by 3 foot high stone rubble wall at the left side of the discharge channel. Both of the auxiliary spillways have a railroad tie along the crest, making the crest elevations 3± inches higher than the principal spillway, or elevation 303.3.

There is no low-level outlet at the dam. A sluice gate with upstream invert elevation of 300.0, is located on the shore of the pond about 60 feet to the right of the dam. The operator reports that there is a 24 inch concrete pipe extending to a small pond north of the dam. This outlet is used to supply water for industrial use at the factory now owned by Kenneth Lynch and Sons. Another outlet, which is now abandoned, is located at the far right end of the dam (See Sheet B-1). It could not be determined if the outlet pipe still exists or what the size of the gate is. However, there is a wooden gate located on the upstream side of the dam. This gate appears to have been operated by a gear hoist which no longer exists, leaving the gate inoperable.

c. Size Classification - (SMALL) - The dam impounds 125 acre-feet of water with the lake level at the top of the dam, which at elevation 306.3, is 12.5 feet above the stream bed at the base of auxiliary spillway #2. According to the *Recommended Guidelines*, a dam with this height or storage capacity is classified as small in size.

d. Hazard Classification - (HIGH) - If the dam were breached, there is potential for loss of more than a few lives, as well as extensive property damage, at homes located directly below the dam at Church Street and at homes 800± feet downstream (See Sheet D-1). At the primary impact area, water in the stream is expected to rise from a depth of 5.8 feet to a depth of 11.3 feet, resulting in velocities of up to 6.5 feet per second and flooding homes by more than 2 feet. More detail is presented in Section 5.5, DAM FAILURE ANALYSIS.

e. Ownership - Kenneth Lynch and Sons
78 Danbury Road
Wilton, Conn.

Kenneth Lynch and Sons purchased property which includes about 1/3 of the dam and the principal spillway from the Revere Textile Corporation in March 1980. The owner before Revere Textile was the U.S. Finishing Company, however no reference as to the date of the sale or owners previous to the U.S. Finishing Company were found. According to the Town of Sterling Assessors Office, Mr. Kenneth Lynch owns only that part of the dam closest to Rt. 14 and which includes the principal spillway. It could not be determined who the owner of the remaining two-thirds of the dam is.

f. Operator - Mr. Warren Armstrong - (203)-564-8770
Kenneth Lynch and Sons

g. Purpose of Dam - At this time, the dam is used to supply water for industrial purposes at the Kenneth Lynch and Sons plant just across Route 14 from the dam.

h. Design and Construction History - No information is available for the original design or construction of the dam. It is evident that another spillway existed, but has been filled with concrete. When this was done is unknown.

i. Normal Operational Procedures - The operator reports that the sluice gate at the northeast side of the pond is opened periodically to fill a small pond, which is used to supply the water for industrial use at his plant. No attempts are made to alter the lake level, which is usually several inches over the principal spillway crest.

1.3 PERTINENT DATA

a. Drainage Area - 42.7 square miles of rolling to mountainous, mostly wooded, relatively undeveloped terrain located in the Thames River Basin.

b. Discharge at Damsite - Normal discharge is over the three spillways. The elevations listed below are approximate National Geodetic Vertical Datum (N.G.V.D.) based on an assumed datum as noted on Sheet B-1.

1. Outlet works (conduits): 24 inch concrete pipe and sluice gate with u/s invert at el. 300.0:	30 cfs
2. Maximum flood at damsite:	Unknown
3. Ungated spillway capacity @ top of dam el. 306.3:	2940 cfs
4. Ungated spillway capacity @ test flood el. 310.6:	10,870 cfs
5. Gated spillway capacity @ normal pool el:	N/A
6. Gated spillway capacity @ test flood el:	N/A
7. Total spillway capacity @ test flood el. 310.6:	10,870 cfs
8. Total project discharge @ top of dam el. 306.3:	2940 cfs
9. Total project discharge @ test flood el. 310.6:	28,000 cfs

c. Elevations (All elevations are approximate N.G.V.D. based on field investigations and an assumed datum, See Sheet B-1).

1. Streambed at toe of dam:	293.8
2. Bottom of cutoff:	N/A
3. Maximum tailwater:	Unknown
4. Normal pool:	303.3
5. Full flood control pool:	N/A
5. Spillway crest:	
Principal	303.0
Auxiliary #1	303.3
Auxiliary #2	303.3
7. Design surcharge (original design):	Unknown
8. Top of dam:	306.3 (low point)
9. Test flood surcharge:	310.6

d. Reservoir (Length in feet)

1. Normal pool:	1300 ft.
2. Flood Control pool:	N/A

3. Spillway crest pool:	1300 ft.
4. Top of dam pool:	1500 ft.
5. Test flood pool:	4500 ft.
e. Storage (Acre-feet)	
1. Normal pool:	50 acre-ft
2. Flood control pool:	N/A
3. Spillway crest pool:	50 acre-ft.
4. Top of dam pool:	125 acre-ft.
5. Test flood pool:	300 acre-ft.
f. Reservoir Surface (Acres)	
1. Normal pool:	16 acres
2. Flood control pool:	N/A
3. Spillway crest pool:	16 acres
4. Top of dam pool:	30 acres
5. Test flood pool:	49 acres
g. Dam	
1. Type:	Stone and mortar masonry with earth embankment upstream
2. Length:	1010 ft. (Total)
3. Height:	12.5 ft.
4. Top width:	12 ft. (Average)
5. Side slopes:	1.5-3.0H to 1V (Upstream) Vertical (Downstream)
6. Zoning:	N/A
7. Impervious Core:	N/A
8. Cutoff:	N/A
9. Grout curtain:	N/A

10. Other:	Stone and mortar masonry section extending entire length of d/s slope

h. Diversion and Regulating Tunnel - N/A

i. Spillway

1. Type:	three broad-crested stone and mortar masonry sections
2. Length of weir:	
Principal	52 ft.
Auxiliary #1	65 ft.
Auxiliary #2	70 ft.
3. Crest elevation:	
Principal	303.0
Auxiliary #1	303.3
Auxiliary #2	303.3
4. Gates:	N/A
5. Upstream Channel:	Flat, sand and gravel, brush
6. Downstream Channel:	Rock, sand and gravel streambed
7. General:	N/A

j. Regulating Outlet

1. Invert:	300.0 (u/s)
2. Size:	24 inch
3. Description:	Concrete
4. Control Mechanism:	Hand operated gate
5. Other:	Abandoned sluice right end of dam

SECTION 2: ENGINEERING DATA

2.1 DESIGN

There is no data available for the design of the dam or the alteration to the spillways.

2.2 CONSTRUCTION

There is no data available for the original construction of the dam or any alterations to the spillways.

2.3 OPERATION

There are no lake level readings taken at the dam. The operator reports that he uses the outlet only to provide water to his factory. There are no formal operation records in existence. An inventory data sheet is available at the State of Connecticut Department of Environmental Protection.

2.4 EVALUATION

a. Availability - Any existing data was provided by the State of Connecticut. The owner made the project available for visual inspection.

b. Adequacy - The limited amount of engineering data available is inadequate to perform an in-depth assessment of the dam, therefore, the assessment of this dam must be based on visual inspection, hydraulic computations, hydrologic judgements and information provided verbally by the owner.

c. Validity - No observable discrepancies could be found in the available record data.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - Based on the visual inspection performed on November 13, 1980, the condition of the dam is judged to be fair. The inspection revealed items requiring maintenance, monitoring and repair. The lake level was at elevation 303.3, with water flowing over the principal spillway at the time of the inspection.

b. Dam

Top of Dam - The top of the dam is very irregular. The top of the stone masonry section, as well as the top of the embankment, slopes down from about 308.4 at the left end to 306.3 near the right end. The embankment is much more irregular, with high and low areas all along the top. At the section of embankment between the principal spillway and Auxiliary Spillway Number 2 there are two holes in the top of the dam. One is approximately 30 feet from Auxiliary Spillway Number 2 and measures 10 feet long by 4 feet wide by 1 foot deep. The other is 70+ feet from the spillway and 2 feet in diameter by 1.5 feet deep (Photo 10). About 20 feet to the right of Auxiliary Spillway Number 1, there is an 18 foot wide section where the top course of masonry has been removed. The embankment is low also, forming a depression about 9 inches below the rest of the dam in this area. The section of embankment just upstream from the abandoned spillway (See Sheet B-1) is about 0.5 feet below the concrete (Photo 9). Trees (up to 1 foot in diameter) and brush were noted along the top of the embankment.

Upstream Slope - The upstream slope is irregular along the length of the dam, the slope inclination ranging between 3H:1V and 1.5H:1V. Several areas are eroded due to lack of riprap protection and trespassing (Overview Photo, Photos 2 and 3). The protective cover consists of grass, weeds and brush.

Downstream Slope - The downstream slope is the vertical face of the stone and mortar masonry section. The masonry appears to be in good condition with good vertical and horizontal alignment (Overview Photo 4). No seepage was observed at the face of the masonry. However, a clear seep of approximately 1 gpm was noted on the downstream side of the dam about 30 feet below the abandoned spillway (Photo 11 and Sheet B-1). No seepage was observed at the joints between the concrete used to fill this spillway and the old masonry. Seepage of about 10 gpm was observed at the far right end of the dam. This seepage is also clear and is emanating from an area about 70 feet directly downstream from an old abandoned sluice gate. By the gulley formed here and the location of the seep, it is possible that this area may have been the outlet for this sluice and the gate is now leaking (Photo 12 and Sheet B-1).

Spillways

Principal spillway - Flow was over this spillway only, at the time of the inspection (Photo 7). The masonry appeared to be in fair condition although it was difficult to inspect because of the flow. The masonry wingwalls at each end of the spillway and the dry-laid stone wall along the right side of the discharge channel are in fair condition. There is some small brush and weeds growing between the stone blocks and several large trees are growing from the discharge channel wall (Photo 7).

Auxiliary Spillway #1 - A wood railroad tie extends across the length of this spillway, raising the crest about 3 inches (Photo 5). The masonry is quite rough with missing mortar and some weeds growing from the surface of the weir. Although no flow was going over the weir, there was substantial flow in the discharge channel (Photos 1 and 5). Most of the flow is through a 3 foot diameter hole on the center upstream side of the spillway which then continues through the weir.

Auxiliary Spillway #2 - A wood railroad tie extends across the crest of this spillway also, raising the crest 3± inches to elevation 303.3. The masonry is in fair condition except for the bottom coarses of stone. In this area, the mortar is missing and some of the masonry is broken up. Brush and weeds are growing from the upper part of the weir and in the approach and discharge channels (Photos 6 and 8). The left spillway wall has several large cracks where there is some displacement of the stone blocks with one of the cap stones missing (Photo 6). All the flow at this spillway is also through or under the weir. Most of the discharge is through two holes at the upstream side of the weir. The largest is 15± feet from the left spillway wall and measures 5 feet in diameter and about 3 feet deep (Photo 8). The other is at the center of the spillway and measures about 3 feet in diameter and 3 feet deep. Wood debris is collecting in the approach channel as well as in the discharge channel.

c. Appurtenant Structures - The sluice gate for the 24 inch concrete outlet could not be observed. The concrete intake is in good condition and the metal trash rack is free of any debris. The gear box and stem appear to be in good condition.

d. Reservoir Area - The area surrounding the lake is steep-sided and wooded on the east and west, with a road (Church Street) running along the west side of the lake. The south side of the lake is flat and swampy. There is no development except at the northwest corner of the lake and below the dam.

e. Downstream Channel - The discharge channels for the principal spillway and auxiliary spillway #2 merge just below the dam and pass under Route 14 at the intersection of Church Street and Route 14. The discharge channel for auxiliary spillway #1 passes under Church Street directly below the dam and under Route 14 about 600 feet further downstream. About 1200 feet below the dam, the two channels merge to again form the Moosup River.

3.2 EVALUATION

Based upon the visual inspection, this dam is assessed as being in fair condition. The following features which could influence the future condition and/or stability of the dam were identified.

1. The flow through the auxiliary spillways could lead to failure of these structures if allowed to continue.

2. Seepage at the downstream slope could lead to failure of the embankment and masonry sections of the dam, and should be investigated.

3. Weeds and brush growing from the stone masonry structures at the spillways will help to accelerate deterioraton of the masonry, leading to possible failure of these structures.

4. The growth of brush and trees on the embankment and at the toe of the dam if left unchecked, could result in root penetration and weakening of the dam by uprooting or providing seepage paths through the embankment.

5. The lack of proper riprap protection on the upstream slope is, and will continue to result in erosion and sloughing of this slope.

6. The low areas in the top of the embankment will provide areas of concentrated discharge over the top of the dam and possibly lead to erosion of the embankment and failure of the dam, should the dam become overtopped.

SECTION 4: OPERATION PROCEDURES

4.1 REGULATING PROCEDURES

a. General - No formal operation procedures exist other than opening the sluice gate periodically to provide water at the factory across Route 14 from the dam. The lake level was at 303.3, with 3 inches of water over the principal spillway during the inspection on November 13, 1980. The outlet was closed.

b. Description of any formal warning system in effect - No formal warning system is in effect.

4.2 MAINTENANCE PROCEDURES

a. General - There is no formal maintenance procedures at the dam.

b. Operating Facilities - No formal program for maintenance of the operating facilities is in effect.

4.3 EVALUATION

A formal program of operation and maintenance procedures should be implemented, including documentation of lake levels for future reference. Also, a formal warning system whould be developed within the time frame indicated in Section 7.1(c). Remedial operation and maintenance recommendations are presented in Section 7.

SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The watershed is 42.7 square miles of rolling to mountainous, mostly wooded terrain, with very little development. Elevations in the watershed range between 680.0 and 303.0. The dam has three spillways, with the principal spillway having a crest elevation of 303.0. The maximum impoundment to the top of the dam (El. 306.3) is estimated to be 125 acre-feet and estimated storage below the principal spillway crest is 50 acre-feet.

The dam is classified as small in size and having a high hazard classification.

5.2 DESIGN DATA

No hydraulic design data are available for this dam.

5.3 EXPERIENCE DATA

No information on any serious problem situations arising at the dam was found. However, immediately below the dam, homes on Church Street as well as the playground, were reported to have been flooded on numerous occasions according to residents in the vicinity. The maximum previous discharge at this dam is unknown.

5.4 TEST FLOOD ANALYSIS

Based upon the Army Corps of Engineers' "Preliminary Guidance for Estimating Maximum Probable Discharges", dated March 1978, the watershed classification (rolling to mountainous), and a drainage area of 42.7 square miles; a PMF of 56,800 cfs, or 1330 cfs per square mile, is estimated at the dam site. The dam is classified as a small size high hazard dam. Therefore, the test flood range to be considered is from the ½ PMF to the PMF. Due to the small size of the dam, a test flood of ½ PMF is selected for Sterling Pond Dam.

The peak inflow to the pond at the ½ PMF is 28,400 cfs and the peak outflow is estimated to be 28,000 cfs (maximum pool elevation at 310.6) with the dam overtopped by 4.3 feet. The total spillway capacity with the pool at the top of the dam (elevation 306.3) is estimated to be 2940 cfs, which is 10% of the routed test flood outflow. The total spillway capacity at the peak test flood elevation (310.6) is 10,870 cfs, which is 39% of the routed test flood outflow.

5.5 DAM FAILURE ANALYSIS

Several homes, a playground and a store, located along Church Street just below the dam are situated about 9 feet above the streambed of the Moosup River and would be impacted upon failure of Sterling Pond Dam (See Overview Photo). This area is designated as the primary impact area and is shown as such on Sheet D-1. Also, there are several homes situated near the streambed approximately 800 feet downstream from the dam. These homes could also be flooded upon failure of the dam and are indicated as the secondary impact area on Sheet D-1.

Utilizing the Corps of Engineers April 1978 "Rule of Thumb Guidance for Estimating Downstream Failure Hydrographs", the peak failure outflow due to dam breach is estimated to be 16,150 with an estimated flood depth of 5.5 feet immediately downstream of the dam. The flood routing in the river was performed for peak failure outflow with pool at top of dam. The prefailure flow in the river is estimated to be 1960 cfs with a depth of 5.8 feet water at the primary impact area. After failure, the flood stage is estimated to increase by 5.5 feet at this impact area. Further downstream at the secondary impact area, discharge from Auxilliary Spillway #1 increases the prefailure flow in the river from 1960 cfs to 2940 cfs with a depth of 7 feet of water. After failure, the flood stage is estimated to increase by 3.8 feet at this secondary impact area.

Upon breach of the dam, the water in the stream at the primary impact area is expected to rise from 5.8 feet to 11.3 feet. This rapid rise in the stream depth will produce velocities of about 6.5 fps and flood the store, playground and houses in this area with 2± feet of water. Also, Church Street and Route 14 in this area are expected to be flooded by more than one foot of water, as the capacity of the culvert under Church Street is inadequate to pass the anticipated peak failure outflow of 15,120 cfs. At the secondary impact area, the water in the river is expected to reach a depth of 11± feet and a velocity of up to 5 fps, possibly flooding and damaging homes in this area.

Based upon the hydraulic/hydrologic analysis and the potential loss of more than a few lives as well as severe economic loss, the dam has a high hazard classification.

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL INSPECTION

The dam is a stone and mortar masonry section with an earth embankment on the upstream side. The masonry section measures between 6 and 8 feet above the toe and 12.5 feet above the discharge channel at Auxiliary Spillway #2. The top of the dam (elevation 306.3) measures about 12 feet in width and the inclination of the upstream slope varies between 3.0-1.5 horizontal to 1 vertical. There are three spillways, all of which are of stone and mortar masonry construction. Auxiliary Spillway #1, at the left end of the dam, is 65 feet long with a crest elevation of 303.3; Auxiliary Spillway #2, at the center of the dam, is 70 feet long and also has a crest elevation of 303.3; the principal spillway, at the right end of the dam, is 52 feet long with a crest elevation of 303.0. No evidence of toe drains, piezometers or other seepage control or monitoring devices were found at the dam.

The visual inspection revealed some minor seepage along the downstream slope at the center and right end of the dam. Also, all the flow at the two auxiliary spillways is through the stone masonry weirs. The seepage at the center of the dam is directly below an abandoned spillway which has been filled with concrete. No seepage could be found at the joints between the concrete and original stone masonry. Recommendations for these and other problems at the dam are presented in Section 7.

6.2 DESIGN AND CONSTRUCTION DATA

No information is available for the original design or construction of the dam.

6.3 POST-CONSTRUCTION CHANGES

No information is available for any changes at the dam. However, there is a spillway which has been filled in with concrete at the center of the dam.

6.4 SEISMIC STABILITY

The dam is in Seismic Zone 1 and according to the Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition - Based upon the visual inspection of the site and past performance, the dam is judged to be in fair condition. There are items requiring repair, maintenance and monitoring. These include masonry repair, removal of trees and brush, and seepage monitoring.

Based upon the "Preliminary Guidance for Estimating Maximum Probable Discharge" dated March, 1978 and hydraulic/hydrologic computations, peak inflow to the lake is 28,400 cfs; peak outflow is 28,000 cfs with the dam overtopped by 4.3 feet. The total spillway capacity (3 spillways) with the lake to the top of the dam (el. 306.3) is 2940 cfs; which is equivalent to 10% of the routed test flood outflow.

b. Adequacy of Information - The information is such that an assessment of the condition and stability of the dam must be based solely on visual inspection, history of the dam, and sound engineering judgement.

c. Urgency - It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within 1 year of the owner(s) receipt of this report.

7.2 RECOMMENDATIONS

The owner(s) should retain a registered professional engineer qualified in dam design and inspection to perform services pertaining to the following items. Recommendations to establish corrective measures should be made by the engineer and implemented by the owner.

1. A detailed analysis to more accurately determine the project discharge capacity, project overtopping potential and any necessary solutions.

2. Investigation of the principal spillway during no-flow conditions and further investigation of the auxiliary spillways to determine recommended procedures for repair of the spillway structures.

3. Development of a program to investigate the origin and significance of seepage at the center of the embankment below the abandoned spillway and at the right end of the dam below the abandoned outlet. Recommendations should be made for monitoring or elimination of this seepage.

4. Recommended procedures for installation of a means of completely drawing down the pond should be established.

5. All trees should be removed from the top, upstream slope and within 10 feet of the toe of the dam. This should include removal of root systems, proper backfilling and replacement of a protective growth.

6. Riprap should be placed on the upstream slope between the expected high and low water elevations.

7. The top of the dam should be regraded to eliminate holes and low areas in the top of the embankment and protective growth re-established. The holes in the top of the embankment between the principal spillway and Auxiliary Spillway Number 2 should be investigated to determine their origin, possible damage to the dam, and correct procedures for repair.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures - The following measures should be undertaken within time period indicated in Section 7.1c, and continued on a regular basis.

1. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference. A program for monthly inspection by the owner(s) or owner(s) representative should be developed and include proper documentation.

2. A comprehensive program of inspection by a registered professional engineer qualified in dam design and inspection should be instituted on an annual basis.

3. The owner(s) should develop and implement a downstream warning system in case of emergency at the dam.

4. Brush should be removed from the top and upstream slope of the embankment. This procedure should be continued on a regular basis.

5. Brush and debris should be removed from the spillway approach and discharge channels. This procedure should be continued on a regular basis.

6. Trees and brush should be removed from between the stone blocks at the masonry structures and the masonry repointed where needed.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT: STERLING POND DAM DATE: November [illegible] 2

TIME: 2:00PM - [illegible]

WEATHER: Sunny, [illegible]

W.S. ELEV. 1033 U.S. [illegible] DN. S

PARTY:	INITIALS:	DISCIPLINE:
1. [illegible] M Heynen	PMH	[illegible] Engineer
2. [illegible] A. Costello	JAC	Geologist
3. Mark Athey	MA	DTC [illegible]
4. Fred. Segaline	FS	Land Surveyor
5.		
6.		

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Embankment	JAC, PMH, MA, FS	A-2
2.	Emergency Spillway	JAC, PMH, MA, FS	A-3
3.	Auxiliary Spillway #1	JAC, PMH, MA, FS	A-4
4.	Auxiliary Spillway #2	JAC, PMH, MA, FS	A-5
5.	Intake/Gate Structure	JAC, PMH, MA, FS	A-6
6.			
7.			
8.			
9.			
10.			
11.			
12.			

PERIODIC INSPECTION CHECK LIST

PROJECT STERLING POND DAM DATE Nov. 13, 1980

PROJECT FEATURE Embankment BY JA, PM, MA, FS

AREA EVALUATED		CONDITION
DAM EMBANKMENT		
Crest Elevation		varies; 308± to 306.3
Current Pool Elevation		303.3
Maximum Impoundment to Date		Unknown
Surface Cracks		None visible
Pavement Condition		N/A
Movement or Settlement of Crest		None observed
Lateral Movement		
Vertical Alignment		stone masonry wall at d/s slope appears good
Horizontal Alignment		
Condition at Abutment and at Concrete Structures		Good
Indications of Movement of Structural Items on Slopes		None
Trespassing on Slopes		yes- some areas of u/s slope
Sloughing or Erosion of Slopes or Abutments		yes- low areas & holes on top of embankment, erosion d/s slope
Rock Slope Protection-Riprap Failures		No riprap visible
Unusual Movement or Cracking at or Near Toes		None
Unusual Embankment or Downstream Seepage		yes- at center of dam - 1± gpm right end of dam - 10± gpm
Piping or Boils		None observed
Foundation Drainage Features		
Toe Drains		
Instrumentation System		

PERIODIC INSPECTION CHECK LIST

PROJECT STERLING POND DAM DATE Nov 13, 1980

PROJECT FEATURE Principal Spillway BY [illegible] A.E.

AREA EVALUATED	CONDITION
OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a) Approach Channel	
General Condition	Flat, sand & gravel, clear of debris
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Good
b) Weir and Training Walls	
General Condition of Concrete	Stone & mortar masonry - fair
Rust or Staining	N/A
Spalling	Some mortar missing, trees & brush growing between stones
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None
Drain Holes	None
c) Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some
Floor of Channel	boulders, natural streambed
Other Obstructions	None

PERIODIC INSPECTION CHECK LIST

PROJECT STERLING POND DAM DATE Nov 13, 1980

PROJECT FEATURE Auxiliary Spillway #1 BY [illegible] MAES

AREA EVALUATED		CONDITION
OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS		
a) Approach Channel		
General Condition		Poor - brush, weeds in channel
Loose Rock Overhanging Channel		None
Trees Overhanging Channel		None
Floor of Approach Channel		Holes from seepage
b) Weir and Training Walls		
General Condition of Concrete		Poor - flow through masonry from holes in approach channel
Rust or Staining		
Spalling		Mortar missing & displaced stone @ lower coarse
Any Visible Reinforcing		N/A
Any Seepage or Efflorescence		All flow through spillway structure
Drain Holes		N/A
c) Discharge Channel		
General Condition		Brush, debris in channel
Loose Rock Overhanging Channel		N/A
Trees Overhanging Channel		
Floor of Channel		Boulders, gravel
Other Obstructions		bridge

PERIODIC INSPECTION CHECK LIST

PROJECT STERLING POND DAM DATE Nov 13, 1980

PROJECT FEATURE Auxiliary Spillway # 2 BY JAC, PMS, MA, FS

AREA EVALUATED	CONDITION
OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a) Approach Channel	
General Condition	Poor
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Trees, brush growing in channel
b) Weir and Training Walls	
General Condition of Concrete	Poor - mortar missing & loose stone at lower coarse & left wall
Rust or Staining	
Spalling	N/A
Any Visible Reinforcing	
Any Seepage or Efflorescence	All flow through spillway structure
Drain Holes	N/A
c) Discharge Channel	
General Condition	Poor - trees, brush, debris
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	some
Floor of Channel	Boulders, gravel
Other Obstructions	None

PERIODIC INSPECTION CHECK LIST

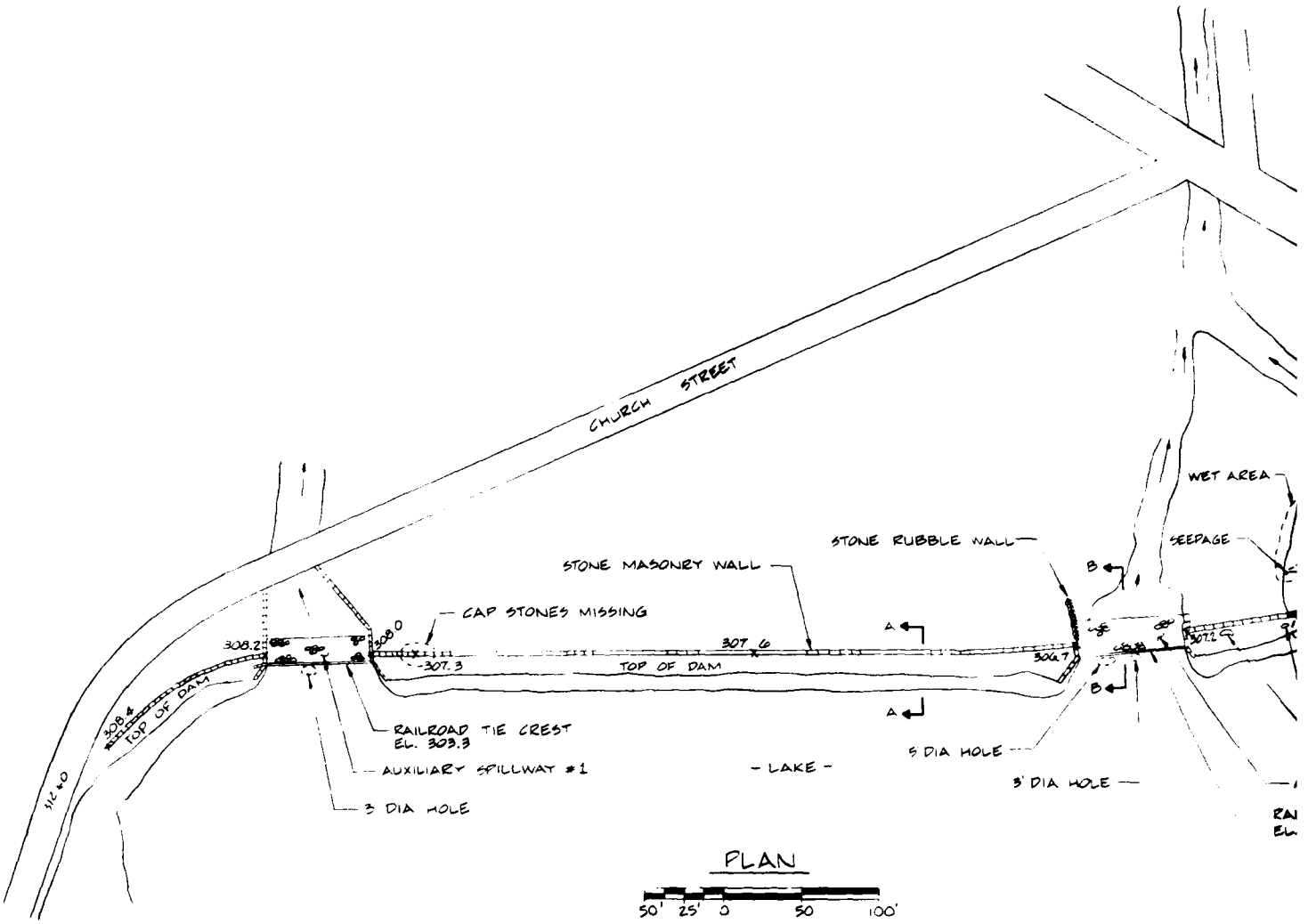
PROJECT STERLING POND DAM DATE Nov. [illegible] 19[illegible]

PROJECT FEATURE Gate/Intake Structure. BY [illegible], MA [illegible]

AREA EVALUATED		CONDITION
OUTLET WORKS-CONTROL TOWER		
a) Concrete and Structural		
General Condition		Good
Condition of Joints		Good
Spalling		None observed
Visible Reinforcing		
Rusting or Staining of Concrete		
Any Seepage or Efflorescence		
Joint Alignment		Good
Unusual Seepage or Leaks in Gate Chamber		None observed
Cracks		
Rusting or Corrosion of Steel		
b) Mechanical and Electrical		
Air Vents		N/A
Float Wells		
Crane Hoist		
Elevator		
Hydraulic System		
Service Gates		Could not be observed
Emergency Gates		N/A
Lightning Protection System		
Emergency Power System		
Wiring and Lighting System		

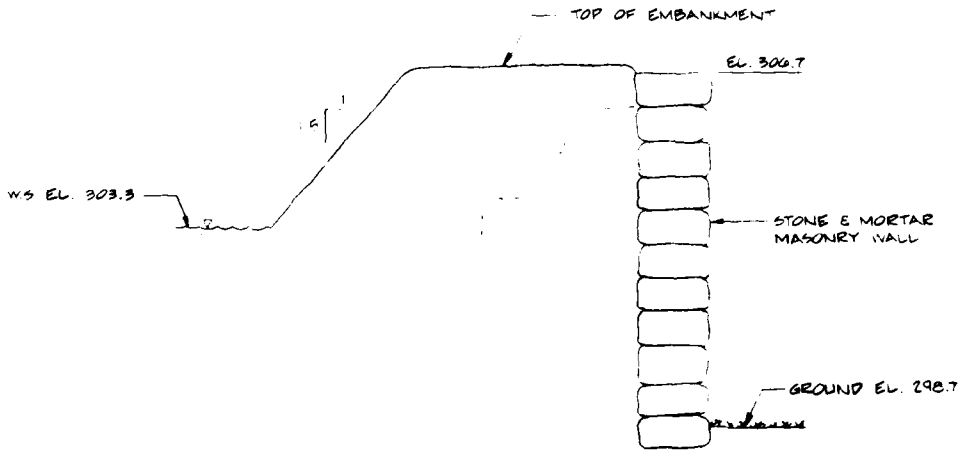
APPENDIX B

ENGINEERING DATA AND CORRESPONDENCE



PLAN

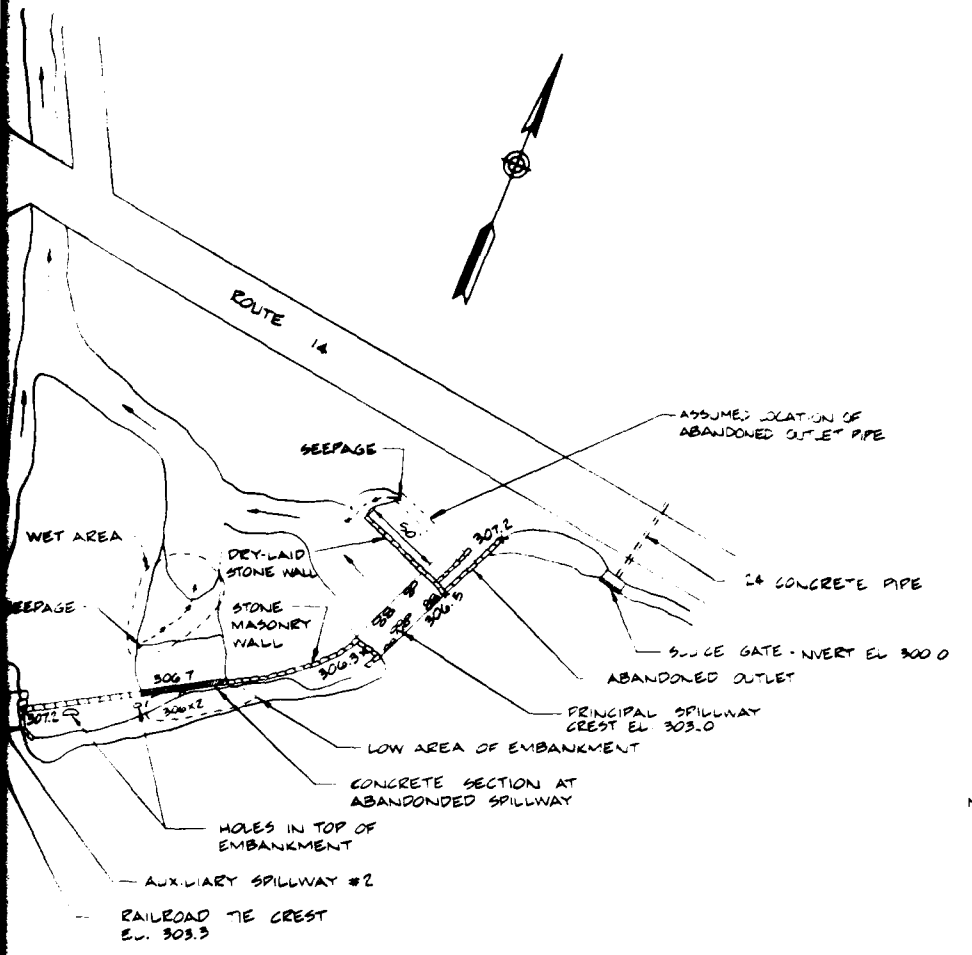
50' 25' 0 50 100'



SECTION A-A

5' 0' 5' 10' HORIZ. 1"=5'

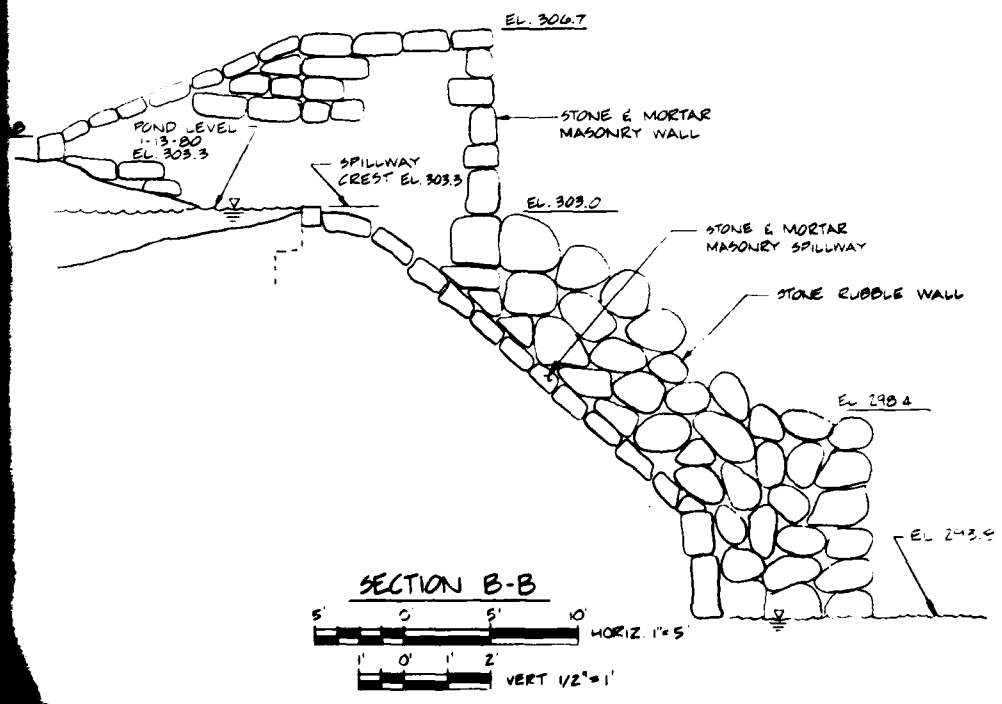
1' 0' 1' 2' VERT 1/2"=1'



NOTES:

1. THIS PLAN WAS COMPILED FROM A CAHN ENGINEERS INSPECTION OF THE DAM DATED NOVEMBER 3 1980. DIMENSIONS SHOWN ARE APPROXIMATE. NOT ALL TOPOGRAPHIC AND/OR STRUCTURAL FEATURES ARE NECESSARILY IDENTIFIED.

2. NO ELEVATIONS WERE AVAILABLE FOR THE DAM THEREFORE, THE WATER SURFACE ELEVATION OF 303.0 FOR THE IMPOUNDMENT SHOWN ON THE U.S.G.S ONECO CONN-R.I. QUADRANGLE MAP WAS ASSUMED TO BE THE APPROXIMATE N.G.V.D ELEVATION OF THE PRINCIPAL SPILLWAY CREST. ALL OTHER ELEVATIONS SHOWN ARE REFERENCED TO THIS SPILLWAY CREST.



SECTION B-B

5' 0 5' 10' HORIZ. 1"=5'

1' 0' 1' 2' VERT 1/2"=1'

CAHN ENGINEERS INC WALLINGFORD, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PLAN & SECTIONS

STERLING POND DAM

MOOSUP RIVER STERLING, CT.

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
E.E.M.			DATE DEC 1980	SHEET B-1

APPENDIX B

EXISTING PLANS

No plans are available.

SUMMARY OF DATA AND CORRESPONDENCE

DATE	TO	FROM	SUBJECT	PAGE
Nov. 13, 1963	Files	State of Connecticut Water Resources Commission	Inventory Data	B-3
Nov. 17, 1980	Cahn Engineers, Inc.	Kenneth Lynch & Sons	Dam Inspection	B-4

No. STER

Inventoried By WPS

Date 13 NOVEMBER 1963

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

LONG 71-49.9
LAT 41-42.4

Name of Dam or Pond STERLING POND

Code No. T 147 S 3.3 G 17 AS F S

Nearest Street Location ROUTE 14

Town STERLING

U.S.G.S. Quad. ONECO

Name of Stream MOOSUP RIVER

Owner ~~THE DUTCHNE CORPORATION~~ REVERE TEXTILE CORP

Address ~~STERLING~~ STERLING PRINT. Railroad Ave Sterling 564-5262

Pond Used For INDUSTRY

Dimensions of Pond: Width 800 FEET Length 1200 FEET Area 11.9 25 ACRES

Total Length of Dam 1000 FEET Length of Spillway 75 FEET

Location of Spillway CENTER OF DAM

Height of Pond Above Stream Bed 10 FEET

Height of Embankment Above Spillway 4 FEET

Type of Spillway Construction MASONRY

Type of Dike Construction MASONRY

Downstream Conditions TOWN OF STERLING

Summary of File Data

Remarks Failure would cause damage

KENNETH LYNCH & SONS

Please reply to:
Box 488, Wilton, Conn. 06897

November 14, 1980

Cahn Engineers Inc.,
30 Alexander Drive
P.O. Box 767
Wallingford, Conn. 06492

Re: Sterling Pond Dam

Attn: Mr. Jay A. Costello

Dear Mr. Costello:

I enjoyed talking to you about the Sterling pond business.

It seems that this pond has two dams. The one closest to Route 14 is my dam and I have access to that and title to it. The other one is further south by a few hundred feet. I am sure you will have no trouble finding this.

You need no permission other than this letter as there is no one on duty there at this dam. They work in the building north of the dam and you can see it right when you are standing there.

I would like to know what this is all about. What is the purpose of this inspection for we are certainly interested, being the owners of the adjacent industrial park?

Yours faithfully,

KENNETH LYNCH & SONS

Kenneth Lynch

Kenneth Lynch, Sr.
President

KL:mck

APPENDIX C

DETAIL PHOTOGRAPHS

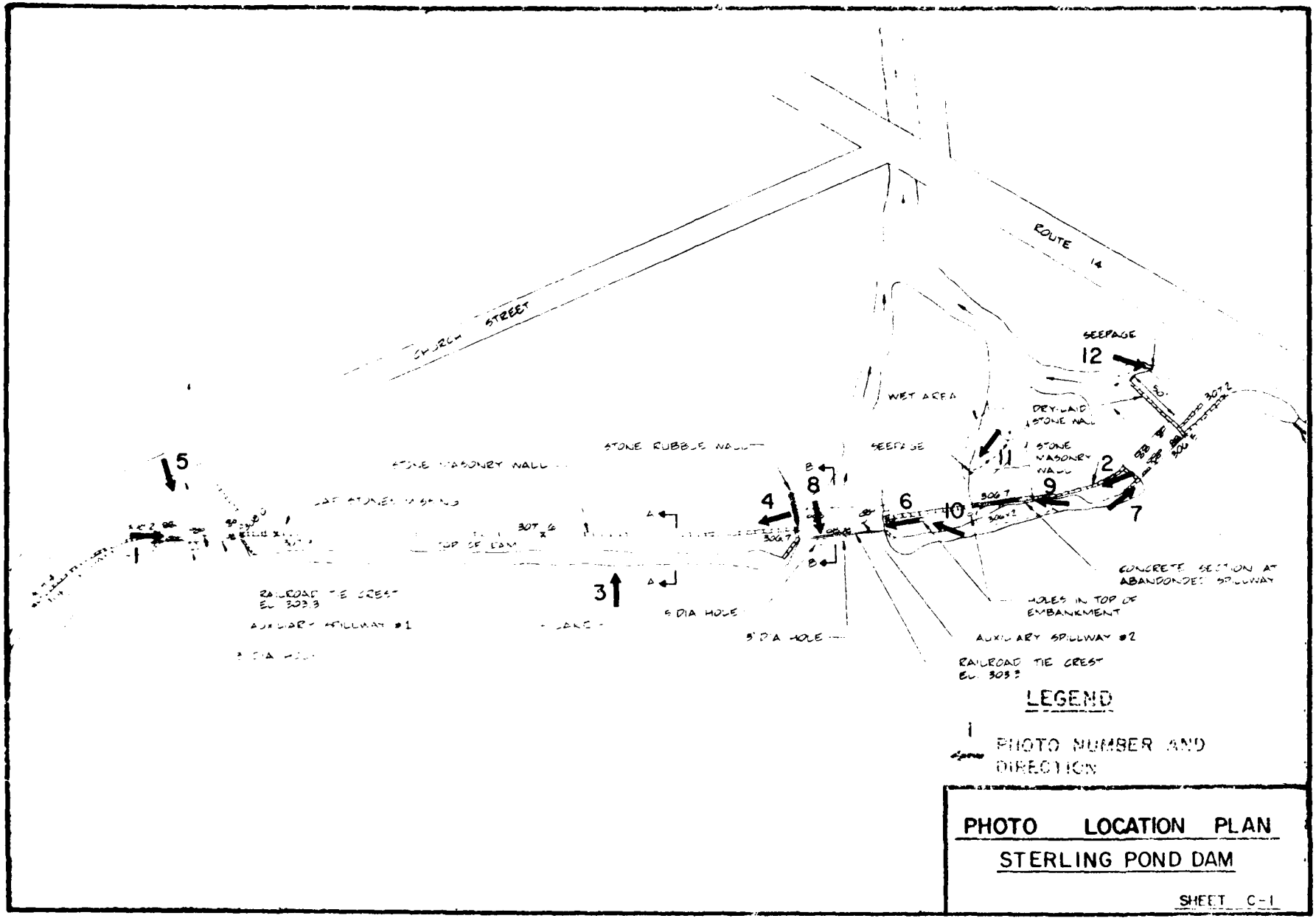

ROUTE 14
CHURCH STREET
SEEPAGE
12
WET AREA
DRY-LAID STONE WALL
STONE MASONRY WALL
STONE RUBBLE WALL
SEEPAGE
STONE MASONRY WALL
5
4
8
6
10
9
2
7
11
3
TOP OF DAM
RAILROAD TIE CREST
EL. 303.3
AUXILIARY SPILLWAY #1
5' DIA HOLE
LAKE
CONCRETE SECTION AT ABANDONED SPILLWAY
HOLES IN TOP OF EMBANKMENT
AUXILIARY SPILLWAY #2
RAILROAD TIE CREST
EL. 303.2
LEGEND
PHOTO NUMBER AND DIRECTION
PHOTO LOCATION PLAN
STERLING POND DAM
SHEET C-1

Photo 1 - Auxiliary Spillway #1 at left end of dam and top of central portion of dam (Nov. 1980)

Photo 2 - Top of dam from principal spillway at right end of dam (Nov. 1980).

US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	Sterling Pond Dam Moosup River Sterling, Conn.
CAHN ENGINEERS INC WALLINGFORD, CONN ENGINEER	INSPECTION OF NON-FED. DAMS	CE # 27785KF DATE Dec. 1980 PAGE C-1

Photo 3 - Erosion at center of upstream slope of embankment (Nov. 1980)

Photo 4 - Stone wall which extends entire length of downstream slope of dam (Nov. 1980).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	Sterling Pond Dam Moosup River Sterling, Conn. CE # 27785KF DATE Dec 1980 PAGE C-2
CAHN ENGINEERS INC WALLINGFORD, CONN ENGINEER	INSPECTION OF NON-FED. DAMS	

Photo 5 - Auxiliary Spillway #1 at left end of dam (Nov. 1980).

Photo 6 - Auxiliary Spillway #2 at center of dam (Nov. 1980).

Photo 7 - Principal Spillway at right end of dam (Nov. 1980).

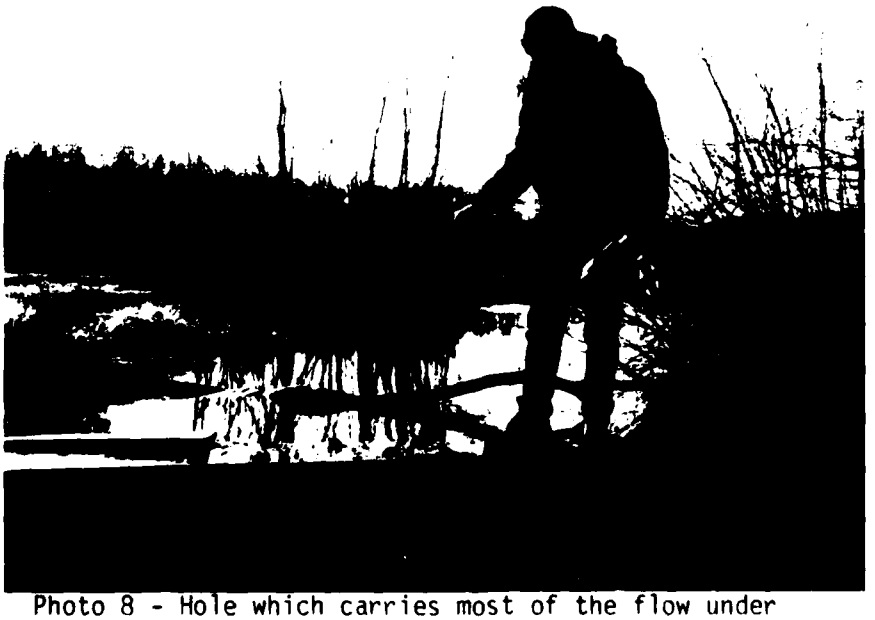


Photo 8 - Hole which carries most of the flow under Auxiliary Spillway #2 (Nov. 1980).

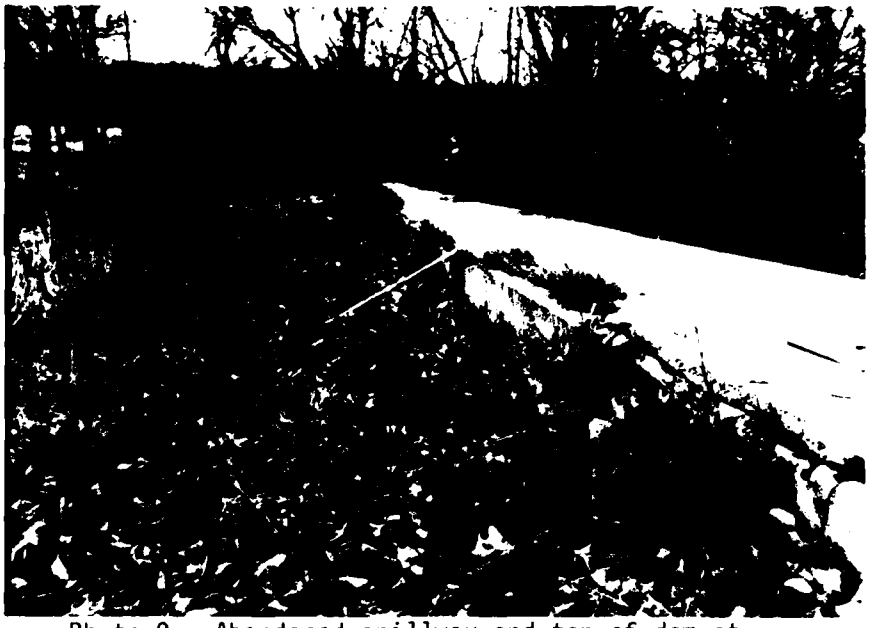


Photo 9 - Abandoned spillway and top of dam at center of embankment between auxiliary spillway #2 and the principal spillway (Nov. 1980).

Photo 10 - Hole in top of embankment just to the right of auxiliary spillway #2 (Nov. 1980).

Photo 11 - Seepage and wet area at the downstream side of abandoned spillway (Nov. 1980).

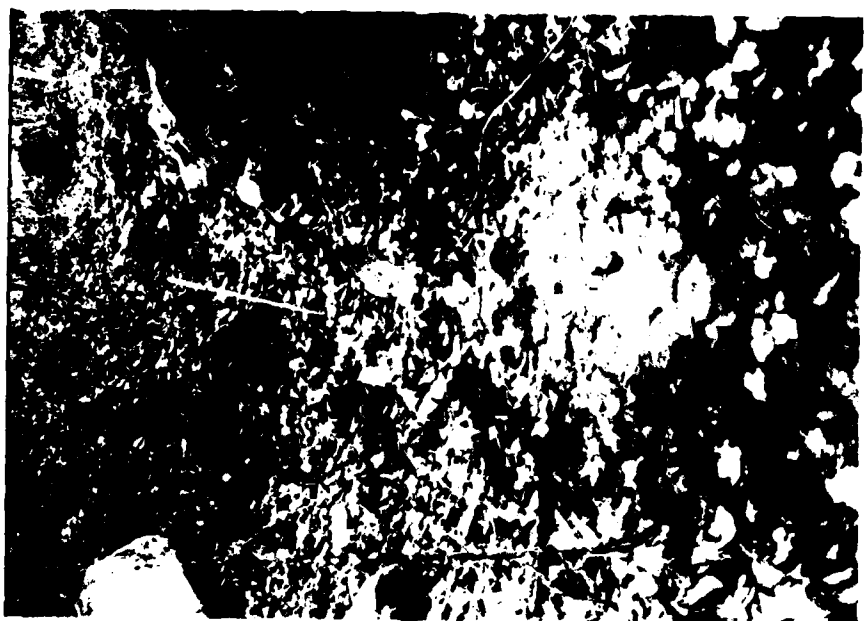
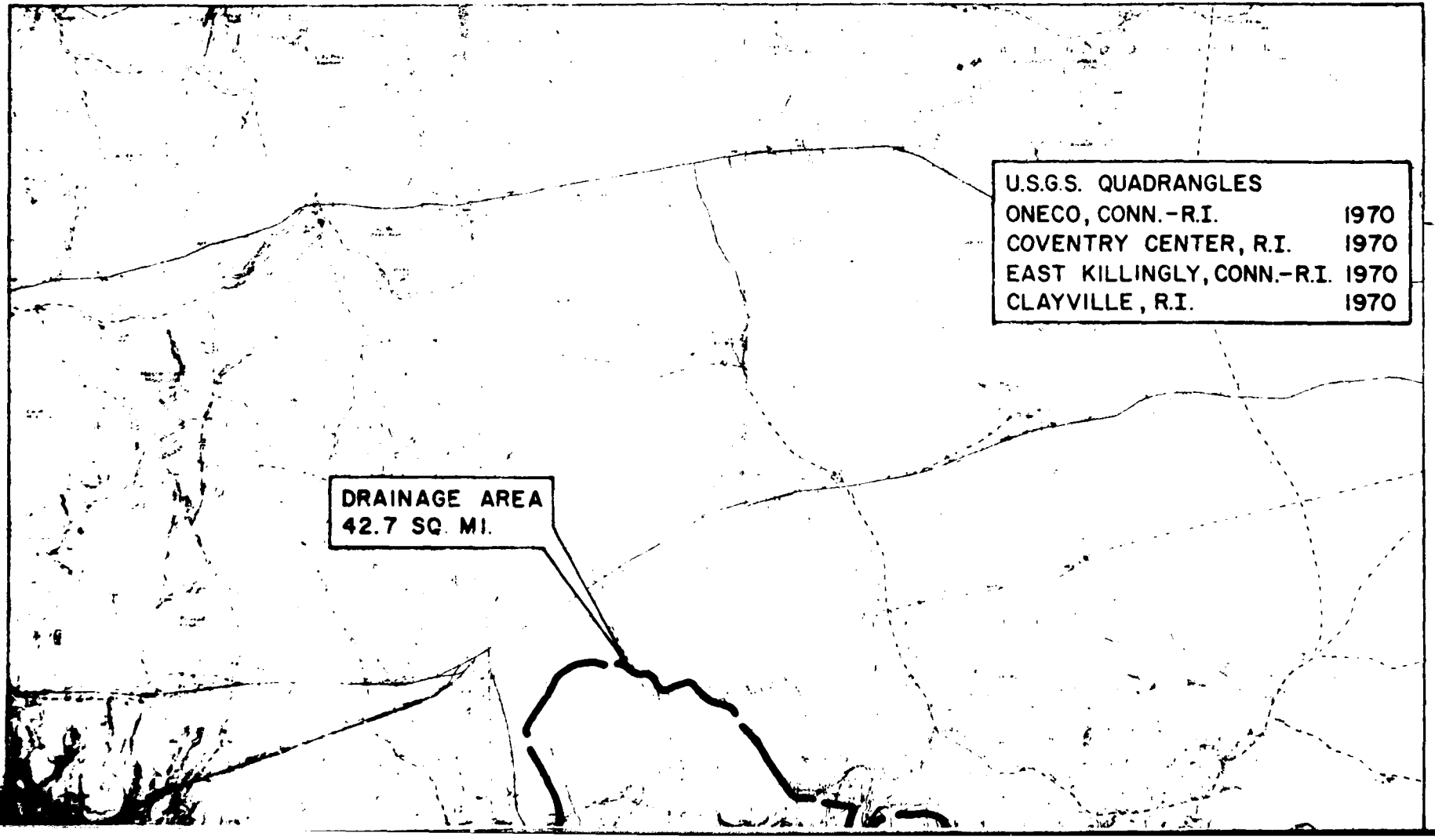


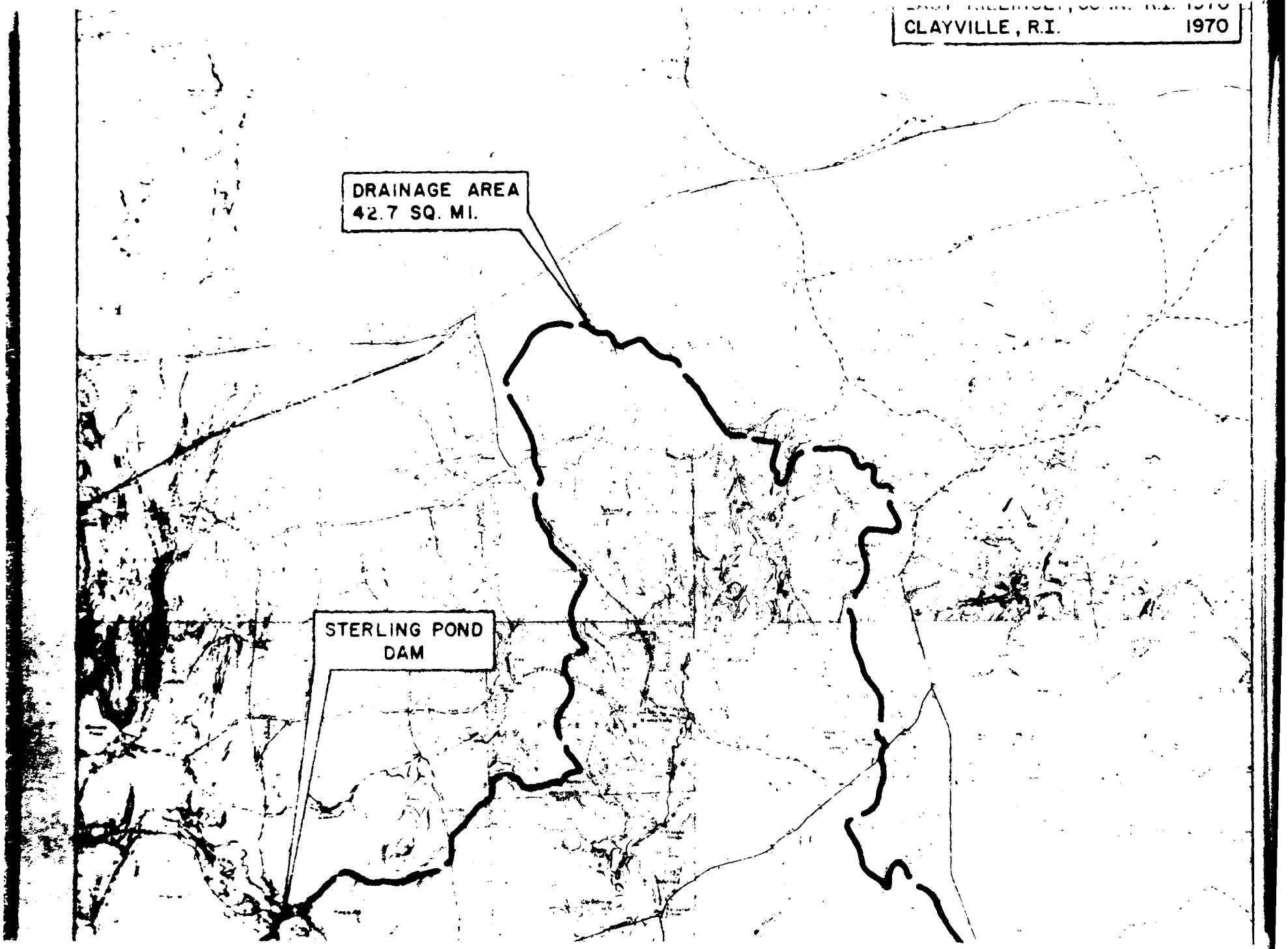
Photo 12 - Seepage at right end of toe directly downstream from abandoned outlet (Nov. 1980).

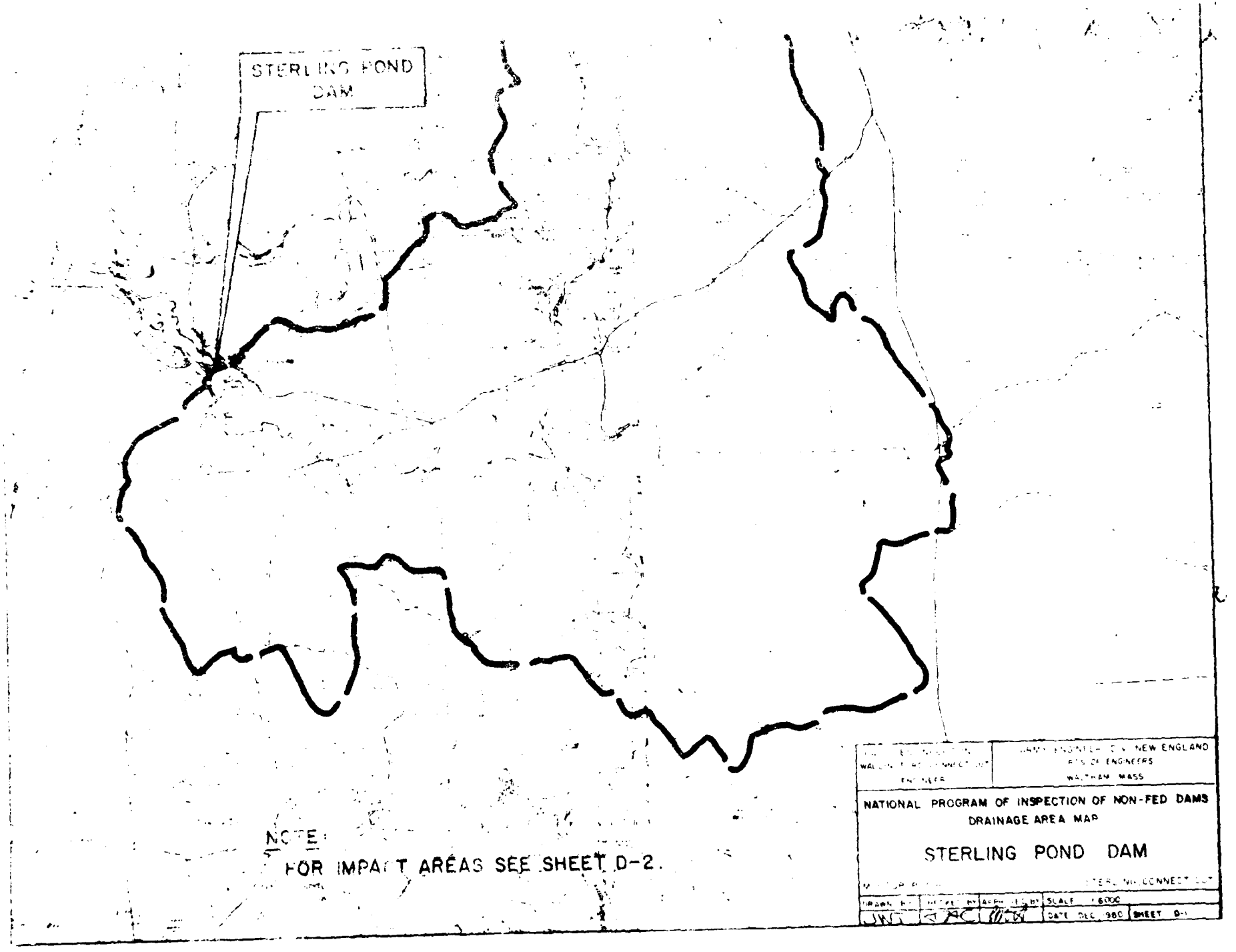
US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	Sterling Pond Dam Moosup River Sterling, Conn.
CAHN ENGINEERS INC WALLINGFORD, CONN ENGINEER	INSPECTION OF NON FED DAMS	... 27785KF DATE Dec. 1980 PAGE C-6

APPENDIX D

HYDRAULICS/HYDROLOGIC COMPUTATIONS


U.S.G.S. QUADRANGLES
ONECO, CONN.-R.I. 1970
COVENTRY CENTER, R.I. 1970
EAST KILLINGLY, CONN.-R.I. 1970
CLAYVILLE, R.I. 1970
DRAINAGE AREA
42.7 SQ. MI.


CLAYVILLE, R.I. 1970
DRAINAGE AREA
42.7 SQ. MI.
STERLING POND
DAM



NOTE:
FOR IMPACT AREAS SEE SHEET D-2.

ENGINEER

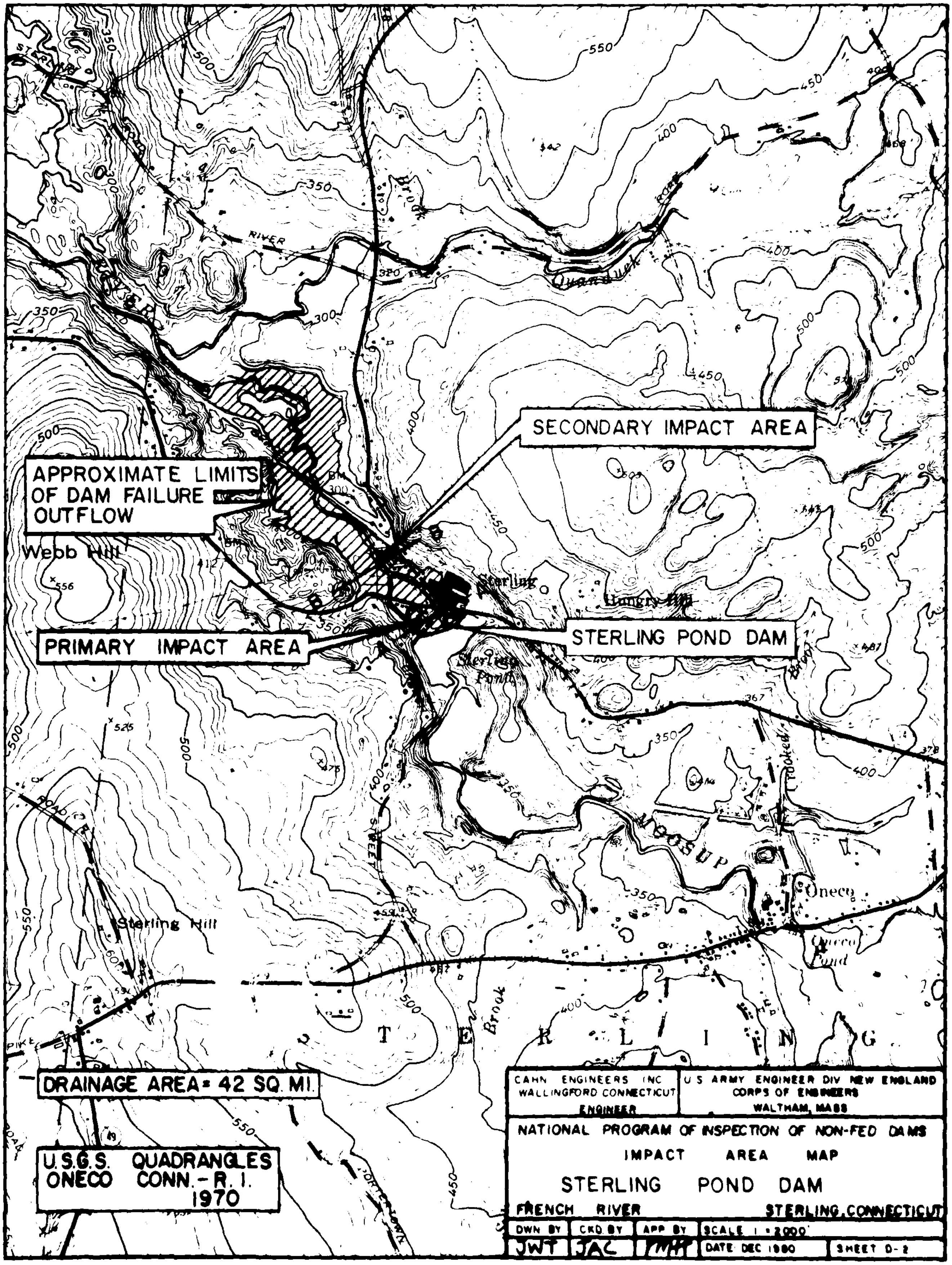
ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS
DRAINAGE AREA MAP

STERLING POND DAM

STERLING CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE 1:6000
JWS			DATE DEC 1980 SHEET D-1


SECONDARY IMPACT AREA
APPROXIMATE LIMITS OF DAM FAILURE OUTFLOW
PRIMARY IMPACT AREA
STERLING POND DAM
Webb Hill
Sterling
Sterling Hill
Oneco
DRAINAGE AREA = 42 SQ. MI.
U.S.G.S. QUADRANGLES
ONECO CONN. - R.I.
1970
CAHN ENGINEERS INC
WALLINGFORD CONNECTICUT
ENGINEER
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS
IMPACT AREA MAP
STERLING POND DAM
FRENCH RIVER
STERLING, CONNECTICUT
DWN BY JWT
CKD BY JAC
APP BY
SCALE 1 = 2000
DATE DEC 1980
SHEET D-2

DIVERSIFIED TECHNOLOGIES CORP. CONSULTING ENGINEERS
NORTH HAVEN, CONN.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 80-10-23 SHEET 1 OF 2
NEW ENGLAND DIVISION COMPUTED BY [illegible] DATE [illegible]
STERLING POND DAM CHECKED BY [illegible] DATE [illegible]

[illegible] FORMANCE AT PEAK [illegible] CONDITIONS
PROBABLE MAXIMUM FLOOD (PMF) DETERMINATION
DRAINAGE AREA —
THE TOTAL DRAINAGE AREA 42.7 SQ MI (FROM CONN DEP BULLETIN NO. 1, 1972, GAZZATTEER OF NATURAL DRAINAGE AREAS)

WATERSHED CLASSIFICATION — "ROLLING" TO "MOUNTAINOUS"
MOSTLY WOODED AND NOT MUCH DEVELOPED.
PMF PEAK INFLOW —
FROM THE CORPS OF ENGINEERS DECEMBER 1971 PEAK FLOW RATES GUIDE CURVES FOR A DRAINAGE AREA OF 42.7 SQ MI, PMF IS SELECTED TO BE IN BETWEEN THE "ROLLING" AND "MOUNTAINOUS"
THE SELECTED INTENSITY = 1330 CFS/SQ MI
THE PEAK INFLOW = 1330 × 42.7 ≅ 57,800 CFS

SIZE CLASSIFICATION —
FOR THE PURPOSE OF DETERMINING THE PROJECT SIZE, THE MAXIMUM STORAGE ELEVATION IS CONSIDERED EQUAL TO THE TOP OF DAM.
TOP OF DAM (LOWER ELVN) = EL. 306.3 [illegible] *
TOP OF THE DAM = EL. 293.8 [illegible]
HEIGHT OF DAM = 12.5 FT

* THE W.S ELVN OF 303 MSL ON THE USGS QUAD SHEET (1970) IS ASSUMED TO BE THE PRINCIPAL SPILLWAY CREST ELEV APPROX ON NATIONAL GEODETIC VERTICAL DATUM (NGVD). ALL OTHER ELVNS ARE REFERENCED TO THIS ASSUMED ELVN AND ARE OBTAINED BASED UPON INFORMATION FURNISHED BY CAHN INC.

DIVERSIFIED TECHNOLOGIES CORP. CONSULTING ENGINEERS
NORTH HAVEN, CONN.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 80-10-23 SHEET 2 OF 3
NEW ENGLAND DIVISION COMPUTED BY [illegible] DATE 12/12/80
STERLING POND DAM CHECKED BY E Butler [illegible] DATE 12 [illegible]

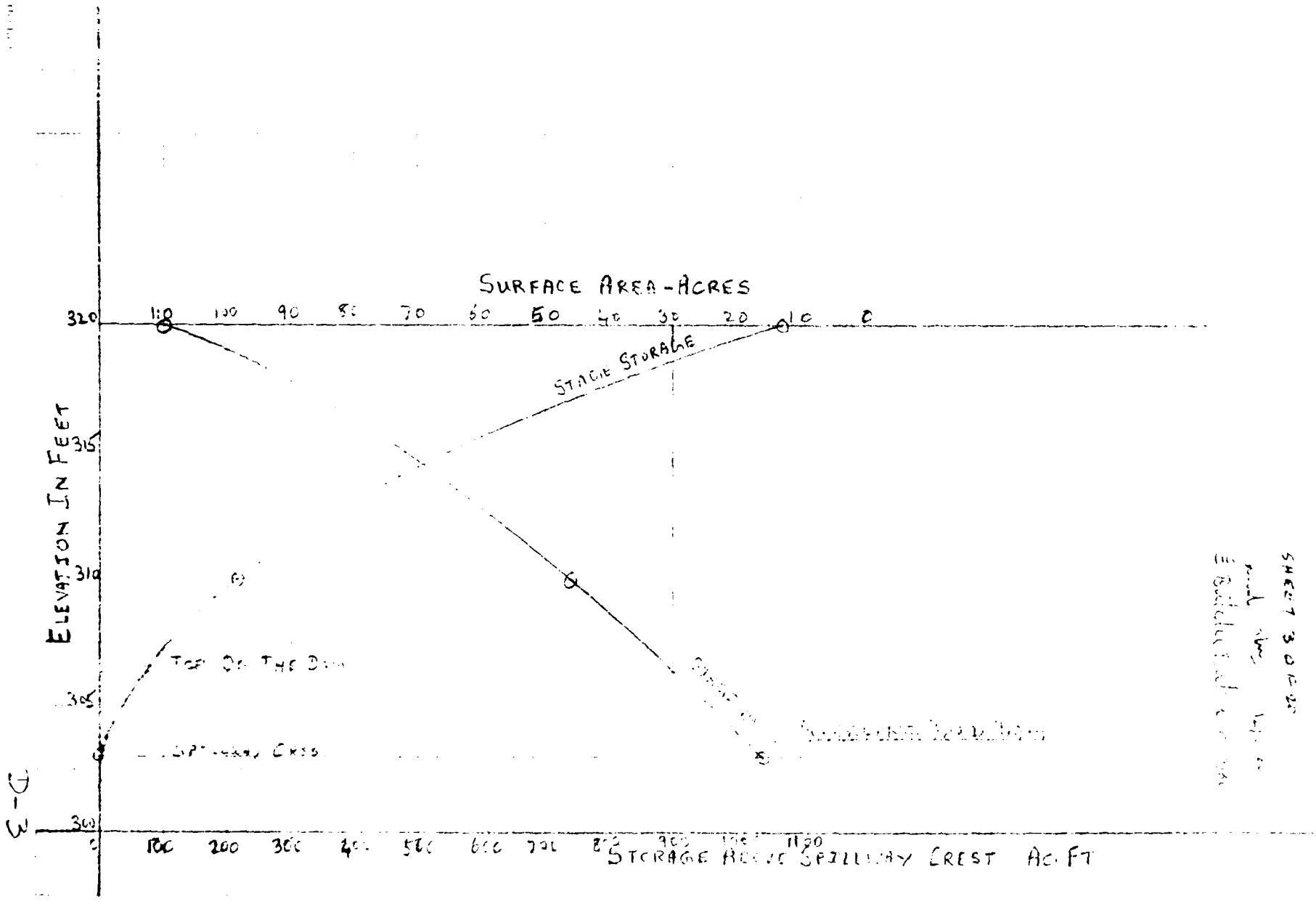
PLANIMETERING FROM USGS MAP FOR POND SURFACE AREAS:
AT EL. 303 (PRINCIPAL SPILLWAY CREST) = 16 ACRES
AT EL. 310 = 30 ACRES
AT EL 320 = 46 ACRES

A STAGE - POND AREA CURVE IS PLOTTED (SHEET 3)
FROM THIS CURVE, POND AREA AT TOP OF DAM = 30 AC.
AVERAGE POND AREA BETWEEN S.WAY CREST & TOP OF DAM ≅ 23 AC.
STORAGE BETWEEN SPILLWAY CREST & TOP OF DAM
= 3.5 × 23 ≅ 75 Ac.Ft

ESTIMATED STORAGE BELOW SPILLWAY CREST = $\frac{1}{3}$ A h
(A = 16 Ac, h = EL. 303 − EL. 293.8 + 9.2) = $\frac{1}{3}$ × 16 × 9.2 ≅ 50 Ac.Ft

∴ MAXIMUM IMPOUNDMENT TO TOP OF DAM = 75 + 50 = 125 Ac.Ft

A STAGE-STORAGE CURVE IS PLOTTED ON SHEET 3
THUS, ACCORDING TO CORPS OF ENGINEERS GUIDELINES
TABLE 1, THE STERLING POND DAM IS CLASSIFIED
AS SMALL BASED UPON THE STORAGE CAPACITY
OF 125 AC.FT (<1000 AND ≥ 50), THE HEIGHT
OF THE DAM IS ONLY 12.5'.


SURFACE AREA-ACRES
120
100
90
80
70
60
50
40
30
20
10
0
320
315
310
305
300
ELEVATION IN FEET
STAGE STORAGE
TOP OF THE DAM
100
200
300
400
500
600
700
800
900
1000
1100
STORAGE ABOVE SPILLWAY CREST AC. FT

C-3

HAZARD POTENTIAL — HIGH HAZARD POTENTIAL DAM BASED UPON DAM BREACH ANALYSIS AND RELATIVE LOCATIONS OF HOUSES AND OTHER STRUCTURES. A DETAILED DISCUSSION OF FAILURE HAZARD POTENTIAL IS INCLUDED AT THE END OF BREACH ANALYSIS SECTION OF APPENDIX - D.

SELECTION OF TEST FLOOD —
FOR THE SMALL SIZE AND HIGH HAZARD POTENTIAL CLASSIFICATION, TABLE 3 OF CORPS OF ENGINEERS RECOMMENDED GUIDELINES, THE TEST FLOOD SHOULD BE IN THE $\frac{1}{2}$ PMF TO PMF RANGE. THE LOWER RANGE IS SELECTED BECAUSE IN THIS FAIRLY SUBSTANTIAL DRAINAGE AREA, IT IS ASSUMED THE STORM IS NOT LIKELY TO CENTER EXACTLY OVER THE DRAINAGE BASIN. ALSO, RAINFALL ISOHYETALS ARE UNLIKELY TO BE UNIFORM TO THE EXACT SHAPE OF THE DRAINAGE BASIN.

TEST FLOOD = $\frac{1}{2}$ PMF

TEST FLOOD PEAK INFLOW = $\frac{1}{2} \times 56,800 =$ 28,400 CFS

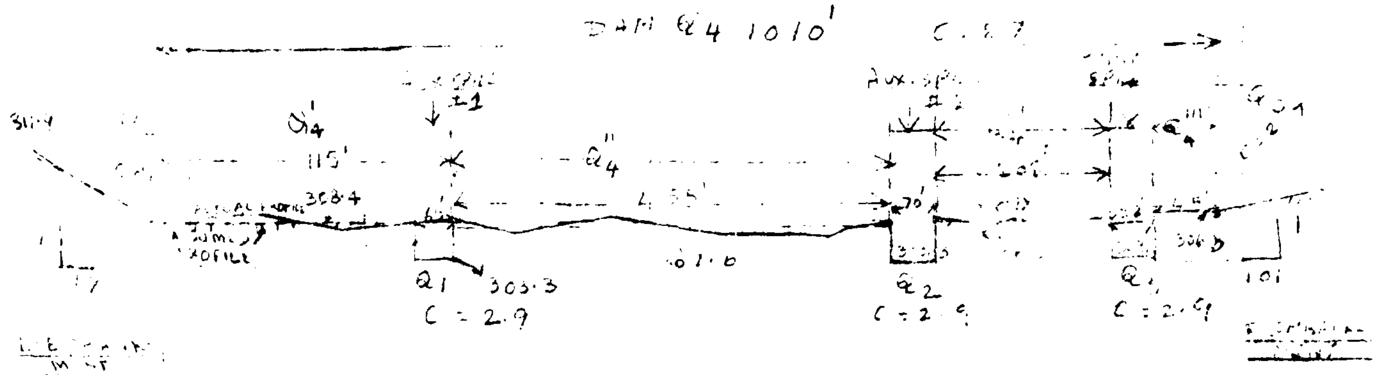
DIVERSIFIED TECHNOLOGIES CORP. CONSULTING ENGINEERS NORTH HAVEN, CONN.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 80-10-23 SHEET 5 OF [illegible]

NEW ENGLAND DIVISION COMPUTED BY [illegible] DATE [illegible]

STERLING POND DAM CHECKED BY [illegible] DATE [illegible]

COMPOSITE DISCHARGE RATING CURVES [illegible]



APPROXIMATE POTENTIAL OVERFLOW PROFILE

(SPILLWAYS & DAM PROFILES BASED UPON CAHN INC'S FIELD INFORMATION)

SPILLWAYS:

AUX. SPILL #1 — BROAD CRESTED WEIR

$Q_1 = CLH^{3/2}$ $= \underline{188.5H^{3/2}}$

C = 2.9 Per Fig 7 of Book 3 Chapter 5 of "Measurements of Peak Discharge at Dams by Indirect Methods" by USGS)

L = 65', Cr EL [illegible]

AUX. SPILL #2 — BROAD CRESTED WEIR

$Q_2 = CLH^{3/2}$ $= \underline{203H^{3/2}}$

C = 2.9, L = 70', Cr EL. [illegible].3

PRINCIPAL SPILLWAY — BROAD CRESTED WEIR

$Q_3 = CLH^{3/2}$ $= \underline{150.8H^{3/2}}$

C = 2.9 Assumed, L = 52', CR EL [illegible].3

DAM: $Q_4 = Q_4' + Q_4'' + Q_4''' + Q_4''''$ Total L [illegible]'

C = 2.7 [illegible] (Earth with [illegible] U/S face) for all sections

$Q_4' = CLH^{3/2} = \underline{310.5H^{3/2}}$ L = 115', Cr EL: 308.4

$Q_4'' = CLH^{3/2} = \underline{1228.5H^{3/2}}$ L = 455', Cr EL. 307.6

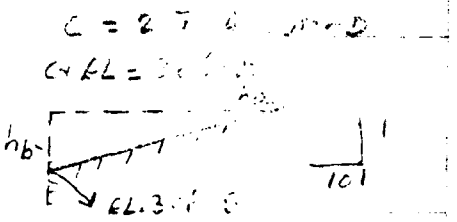
$Q_4''' = CLH^{3/2} = \underline{561.6H^{3/2}}$ L = 208', Cr EL. 306.3

$Q_4'''' = CLH^{3/2} = \underline{121.5H^{3/2}}$ L = 45', Cr EL. 306.8

RIGHT EMBANKMENT:

$$Q_5 = \frac{2}{5} \frac{CL\left(h_b^{5/2} - h_a^{5/2}\right)}{(h_b - h_a)}\ *$$

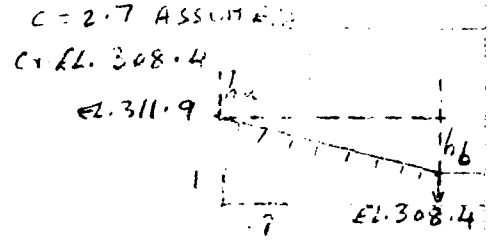
$$= 109.08 h_b^{5/2}$$



LEFT EMBANKMENT:

$$Q_6 = \frac{2}{5} \frac{CL\left(h_b^{5/2} - h_a^{5/2}\right)}{(h_b - h_a)}\ *$$

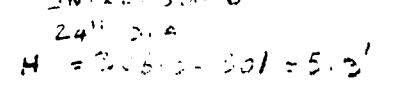
$$= 18.36 h_b^{5/2}$$



SERVICE OUTLET:

$$Q_7 = CA\sqrt{2gH}$$

$$= 30\ CFS$$ NEED TWO GATES



* USGS RECOMMENDED FORMULA FOR MORE PRECISE DISCHARGE OVER INCLINED DAM/EMBANKMENT CREST (Ref: MEASUREMENT OF PEAK DISCHARGES AT DAM BY INDIRECT METHODS, USGS BOOK 3, CHAPTER A 5, PAGE 54, 1968)

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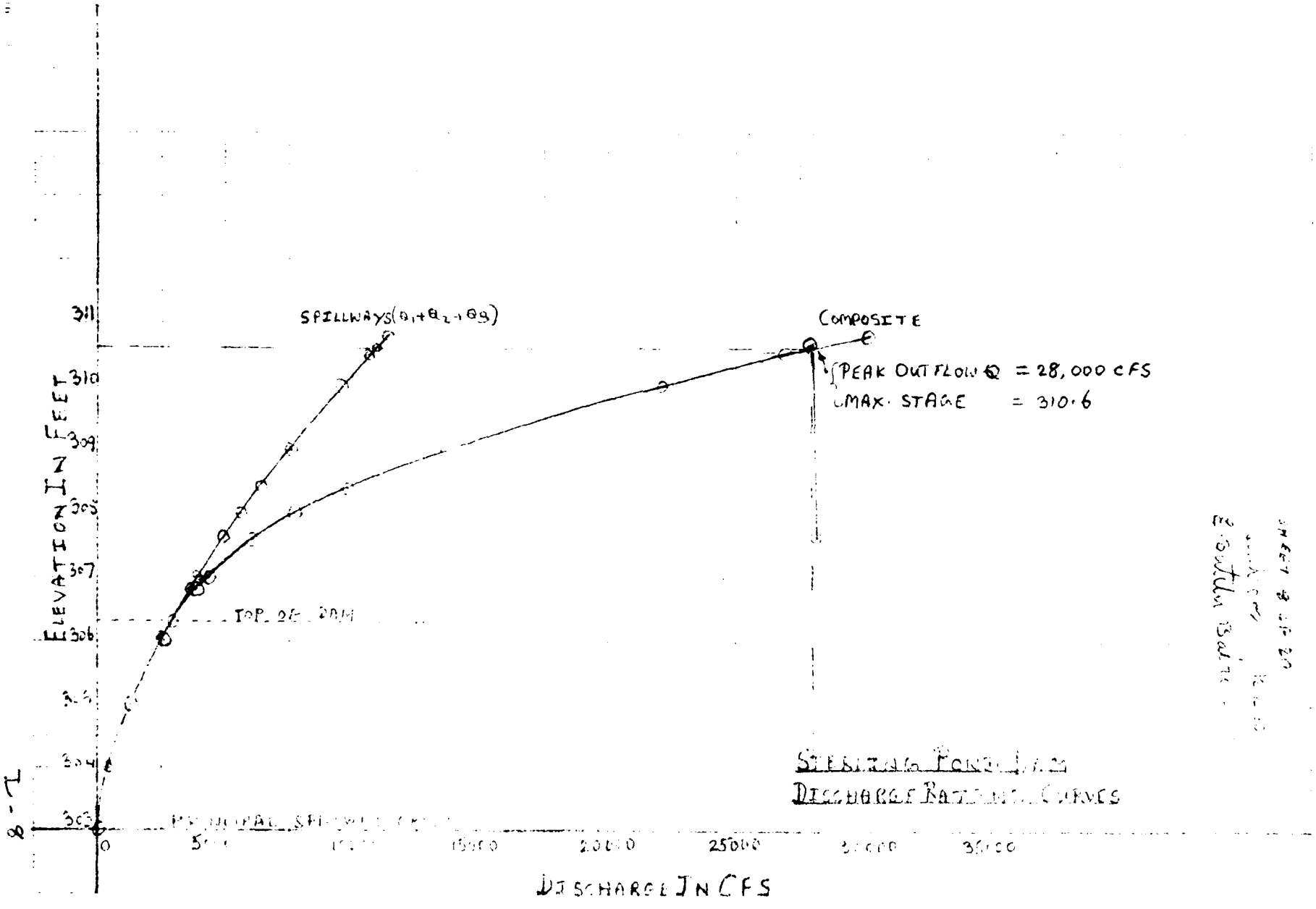
NORTH HAVEN, CONN.

PROJECT: NON FEDERAL DAM INSPECTION PROJECT NO. 80-10-23 SHEET 7 OF [illegible]
NEW ENGLAND DIVISION COMPUTED BY [illegible] DATE [illegible]
STERLING POND DAM CHECKED BY [illegible] DATE [illegible]

TABULATION OF DISCHARGE RATES (CFS)

	ELEV.	[illegible] Q_1	[illegible] Q_2	[illegible] Q_3	TOTAL $Q_1+Q_2+Q_3$	DAM Q_4'	Q_4''	Q_4'''	Q_4''''	TOTAL $Q_4'+Q_4''+Q_4'''+Q_4''''$	Q_5	Q_6	TOTAL Q CFS
PR SPILLER	303	0	0	0	0	0	0	0	0				0
AUX SPILLER	303.3	0	0	25	25	0	0	0	0	0	0	0	25
	304	110	118	150	378	0	0	0	0	0	0	0	378
	305	418	450	426	1294	0	0	0	0	0	0	0	1294
	306	836	900	784	2520	0	0	0	0	0	0	0	2520
TOP OF DAM	306.3	980	1055	905	2940	0	0	0	0	0	0	0	2940
	306.8	1234	1329	1117	3680	0	0	198	0	198	5	0	388[illegible]
	307	1341	1445	1201	3992	0	0	328	11	339	19	0	435[illegible]
	307.6	1690	1810	1488	4978	0	0	832	87	919	[illegible]	0	6025
	308	1920	2068	1386	5374	0	310	1245	160	1715	301	0	7690
	308.4	2171	2238	1992	6401	0	879	1710	246	2835	542	0	9778
	309	2565	2762	2216	7543	1111	2045	2490	396	5037	1078	5	13693
	310	3269	3520	2792	9581	628	4563	3997	696	9884	2500	60	22,0[illegible]
	310.5	3642	3922	3097	10,661	945	6051	4834	865	12,711	3490	117	26,979
MAX MAG → ([illegible])	310.6	3710	4000	3160	10,870	1010	6380	5000	[illegible]	13,290	[illegible]	130	28,050
	310.8	3832	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NOTE: THE DISCH[illegible]
THE OUTFLOW IS INSIGNIFICANT (30 CFS WITH POOL AT TOP OF DAM)
DISCHARGE RATING CURVES FOR TOTAL Q (COMPOSITE) ARE SHOWN ON SHEET 8.



SILVERADO POND DAM
DISCHARGE RATING CURVES

DIVERSIFIED TECHNOLOGIES CORP. CONSULTING ENGINEERS NORTH HAVEN, CONN.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 80-10-23 SHEET 9 OF [illegible]
NEW ENGLAND DIVISION COMPUTED BY [illegible] DATE [illegible]
[illegible]ERLING POND DAM CHECKED BY [illegible] DATE [illegible]

[illegible]RMINATION OF PEAK OUTFLOW —
[illegible] THE CORPS OF ENGINEER'S "SURCHARGE STORAGE [illegible]ING" ALTERNATE METHOD:
[illegible] 28,400 CFS ($\frac{1}{2}$ PMF) THE DISCHARGE [illegible] [illegible] GIVES ELVN = 310.65
[illegible] STAGE - STORAGE CURVE FOR THIS [illegible]
STORAGE = 250 AC.FT.
[illegible]R, = $\frac{250 \times 12}{42.7 \times 640}$ = 0.11" RUNOFF

$QP_2 = QP_1 (1 - \frac{STOR_1}{9.5})$

①	②	③	④	⑤
STOR, INCH	$(1 - \frac{STOR}{9.5})$	STOR, AC-FT = ① × $\frac{42.7 \times 640}{12}$	Q, CFS [illegible] ② × 28,400	[illegible] STOR[illegible] CURVE [illegible] ③
0.05	0.99	114	28,115	310.35
0.11	0.98	250	27,830	310.65

[illegible]MNS ④ & ⑤ ARE PLOTTED ON [illegible] RATING [illegible]VE AND

[illegible] PMF PEAK OUTFLOW Q = 28,0[illegible]
MAX. STAGE = 310.[illegible] NGVD
TOP OF DAM = 305.[illegible] NGVD

[illegible]HE DAM IS EXPECTED TO OVERTOP [illegible]

BREACH ANALYSIS

DOWNSTREAM FAILURE HAZARD —

BREACH OUTFLOW $Q_b = \frac{8}{27} W_b \sqrt{g} y_o^{3/2}$ BASED ON CORPS OF ENGINEERS "RULE OF THUMB" GUIDANCE FOR ESTIMATING D/S DAM FAILURE HYDROGRAPHS

ESTIMATED BREACH WIDTH W_b = 40% OF MID-HEIGHT LENGTH OF DAM

ESTIMATED MID HEIGHT LENGTH OF THE DAM = 510' BASED ON CAHN INC'S FIELD INFORMATION.

$\therefore W_b = 0.4 \times 510 \cong 205$ FT

ESTIMATED WATER DEPTH AT TIME OF FAILURE = 12.5 FT WITH POOL AT TOP OF DAM (EL. 306.3)

$Q_b = \frac{8}{27} \times 205 \times \sqrt{32.2} \times (12.5)^{3/2} \cong 15,250$ CFS

MAX FAILURE OUTFLOW $QP_1 = Q_b$ + PRINCIPAL SPILLWAY DISCHARGE WITH POOL AT TOP

= 15,250 + 900 = 16,150 CFS

BASED ON THE D/S PROFILE OF THE DAM, IT IS CONSIDERED REASONABLE TO PRESUME BREACHING OF THE DAM TO TAKE PLACE IN A SECTION WHICH INCLUDES AUXILIARY SPILLWAY #2. THEREFORE, AUXILIARY SPILLWAY #1 SHALL NOT CONTRIBUTE ANY FLOW TO Q_b. FOR FLOOD ROUTING ANALYSIS IN THE RIVER @ SECTION PP (1000' D/S OF THE DAM), THE DISCHARGE FROM THE PRINCIPAL SPILLWAY IS ADDED TO Q_b. AND FOR ANALYSIS @ SECTION BB (800' BELOW THE DAM), DISCHARGE FROM AUX. SPILLWAY #1 IS ADDED TO THE DISCHARGE QP_2 FLOWING AFTER SECTION AA.

ESTIMATED FAILURE FLOOD DEPTH IMMEDIATELY D/S FROM DAM = 0.44 H

= 5.5 FT

PROJECT [illegible] COMPUTED BY [illegible]

[illegible] CHECKED BY [illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
300	[illegible]	[illegible]	[illegible]

[illegible] AREA AND [illegible] DISCHARGE [illegible]

[illegible] FOR [illegible]

[illegible] FROM FIGURE [illegible]

FOR M STAGE [illegible]

FIGURE GIVES [illegible]

[illegible] OF RESERVOIR [illegible]

$$= 16{,}150 \left(1 - \frac{1}{1.5}\right) = 10{,}766 \text{ cfs}$$

FOR THIS Q/Q_2 THE [illegible]

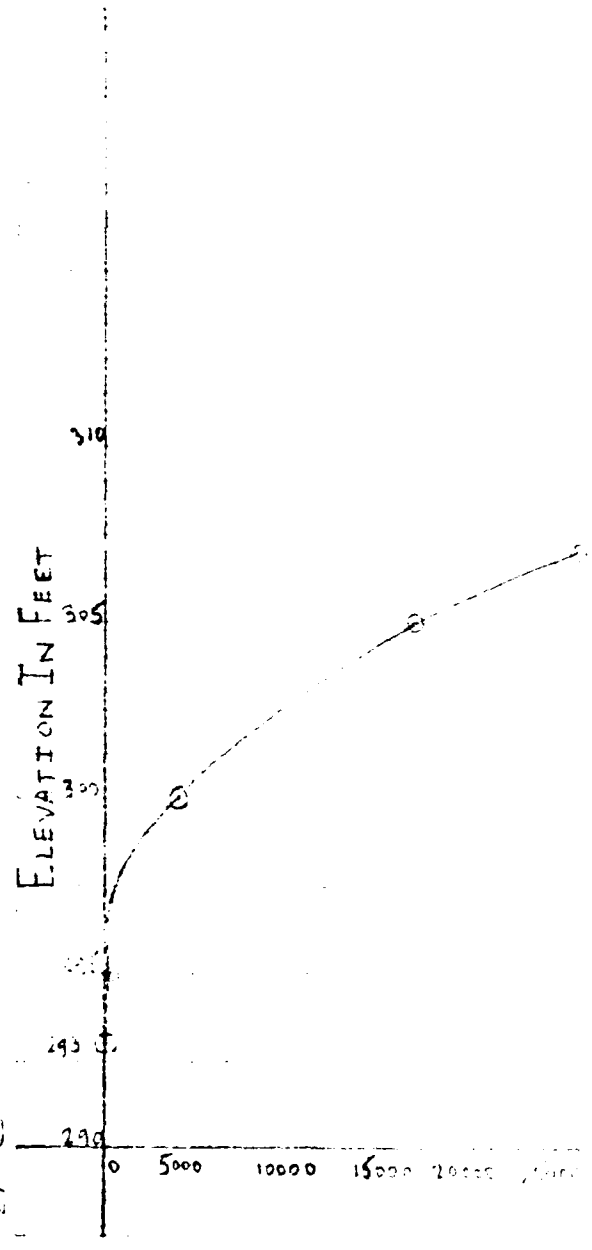
[illegible] ELEV [illegible]

AREA [illegible]

$$\text{AT } V_{2L} = \frac{150 \times 2}{4} = [illegible]$$

RECOMPUTING $Q/Q_2 = 16{,}150 \left(1 - \frac{2}{1.5}\right) =$ [illegible]

ELEVATION IN FEET
310
305
300
HORIZONTAL DISTANCE IN FEET
LOOKING DOWNSTREAM


ELEVATION IN FEET
310
305
300
295
290
0
5000
10000
15000
DISCHARGE IN CFS

SECTION A-A

DIVERSIFIED TECHNOLOGIES CORP. CONSULTING ENGINEERS NORTH HAVEN, CONN.

PROJECT: NON FEDERAL DAM INSPECTION PROJECT NO. 80-10-25 SHEET [illegible] OF [illegible]

NEW ENGLAND DIVISION COMPUTED BY [illegible] DATE [illegible]

STERLING POND DAM CHECKED BY [illegible] DATE [illegible]

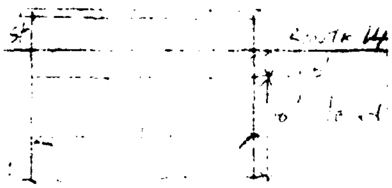
[illegible] STAGE AT SECTION AA = EL 3[illegible].5

[illegible] DEPTH AT SECTION AA = EL 304.3 - [illegible] = [illegible] FT

[illegible] VELOCITY AT SECTION AA = $\frac{15\,[illegible]}{2307}$ = [illegible]

[illegible] AND A NUMBER OF HOUSES [illegible] [illegible] BANK OF THE RIVER @ SECT [illegible] [illegible] STORE AND 1ST FLOOR OF THESE [illegible] [illegible] LOCATED ONLY $9^{\pm}$ FT ABOVE THE RIVER [illegible] THEREFORE, [illegible] BUILDINGS COULD BE FLOODED WITH [illegible] FT. OF WATER AND THERE IS A POTENTIAL OF [illegible] MORE THAN FEW LIVES. IN ADDITION, CHURCH STREET (MODERATELY [illegible] TRAFFIC) WHICH IS 10' ABOVE THE STREAM BED COULD BE SUBMERGED WITH $1^{\pm}$ FT. OF WATER.

APPROXIMATELY ESTIMATING THE [illegible] [illegible] OF THE CULVERT AT CHURCH ST. AND [illegible] (Ref. [illegible] [illegible] hydraulics by [illegible] [illegible] chow, chapter 17, [illegible] 17-[illegible], [illegible]):



FOR THE CULVERT WITH DIMENSIONS AS SHOWN, DISCHARGE [illegible] $\cong$ 4500 [illegible] THEREFORE, THE CULVERT IS NEARLY [illegible] ADEQUATE FOR THE [illegible] 5 [illegible]

[illegible] AT A [illegible]

[illegible] [illegible] [illegible] TO [illegible] POSSIBLE FLOOD DAMAGE [illegible] [illegible] [illegible] OF A CLUSTER OF HOMES [illegible] [illegible] BETWEEN STATE ROUTE 14 AND [illegible] [illegible] CR.

USING MANNING'S EQUATION

$Q = \frac{1.486}{n} \times A \times R^{2/3} \times S^{1/2}$ [illegible]

$= 1.7 \times A \times R^{2/3}$

[illegible] = [illegible] 46 [illegible]

EST. FROM USGS MAP

ELVN	A Sq FT	P	A/P	$R^{2/3}$	Q CFS
290	0	—	—	—	—
295	408	181	2.[illegible]	[illegible]	[illegible]
300	1875	370	5	[illegible]	92.[illegible]5
305	5900	438	8.92	[illegible]	8.545

[illegible] AREA AND STAGE DISCHARGE CURVES ARE PLOTTED FOR SECTION BB

Q_{P_1} = THE OUTFLOW REMAINING AT SECTION BB AFTER DISCHARGE THROUGH AUXILIARY SPILLWAY = 15,[illegible] + [illegible] = 16,100 CFS

FOR PEAK FAILURE OUTFLOW Q_{P_1} = 16,100 CFS

ELVN = 302.12 FROM STAGE DISCHARGE CURVE,

AND STAGE AREA CURVE GIVES, AREA = [illegible] SQ. FT

VOLUME OF REACH $V_1 = \frac{650 \times 2696}{43,560} \cong$ [illegible] AC. FT

STORAGE REMAINING = 125 − 8 $\cong$ 117 AC. FT

FINAL $Q_{P_2} = Q_{P_1}\left(1 - \frac{V_1}{S}\right) = 16,100\left(1 - \frac{40}{117}\right) \cong$ [illegible],600 CFS

FOR THIS Q_{P_2} ELVN = 300.5 AND AREA = [illegible] SQ. FT.

$\therefore V_2 = \frac{650 \times 2034}{43,560} \cong$ 30 AC. FT

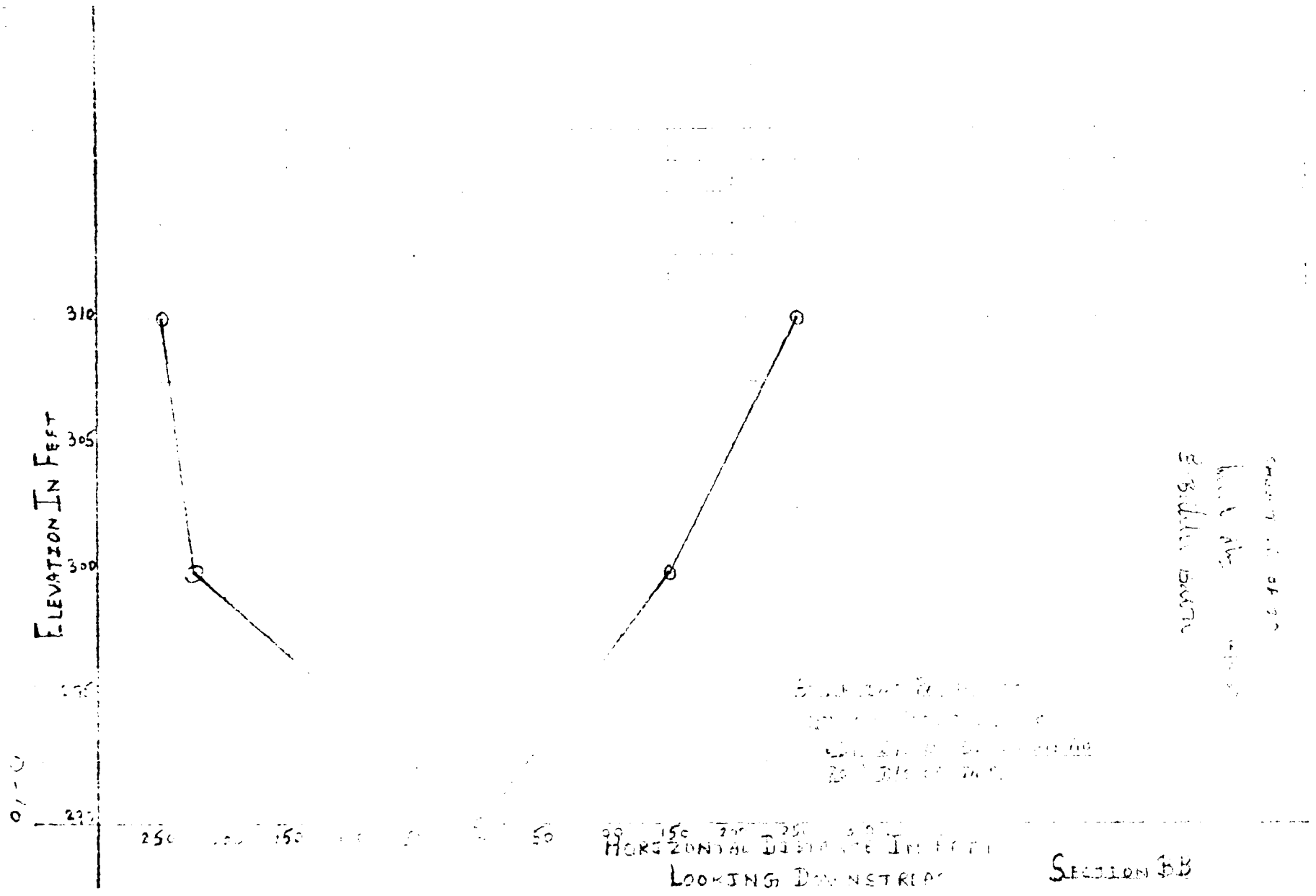
[illegible] $Q_{P_2} = 16,[illegible]\left(1 - \frac{40+30}{117}\right) \cong$ [illegible] CFS

[illegible] STAGE AT SECTION BB = 300.8

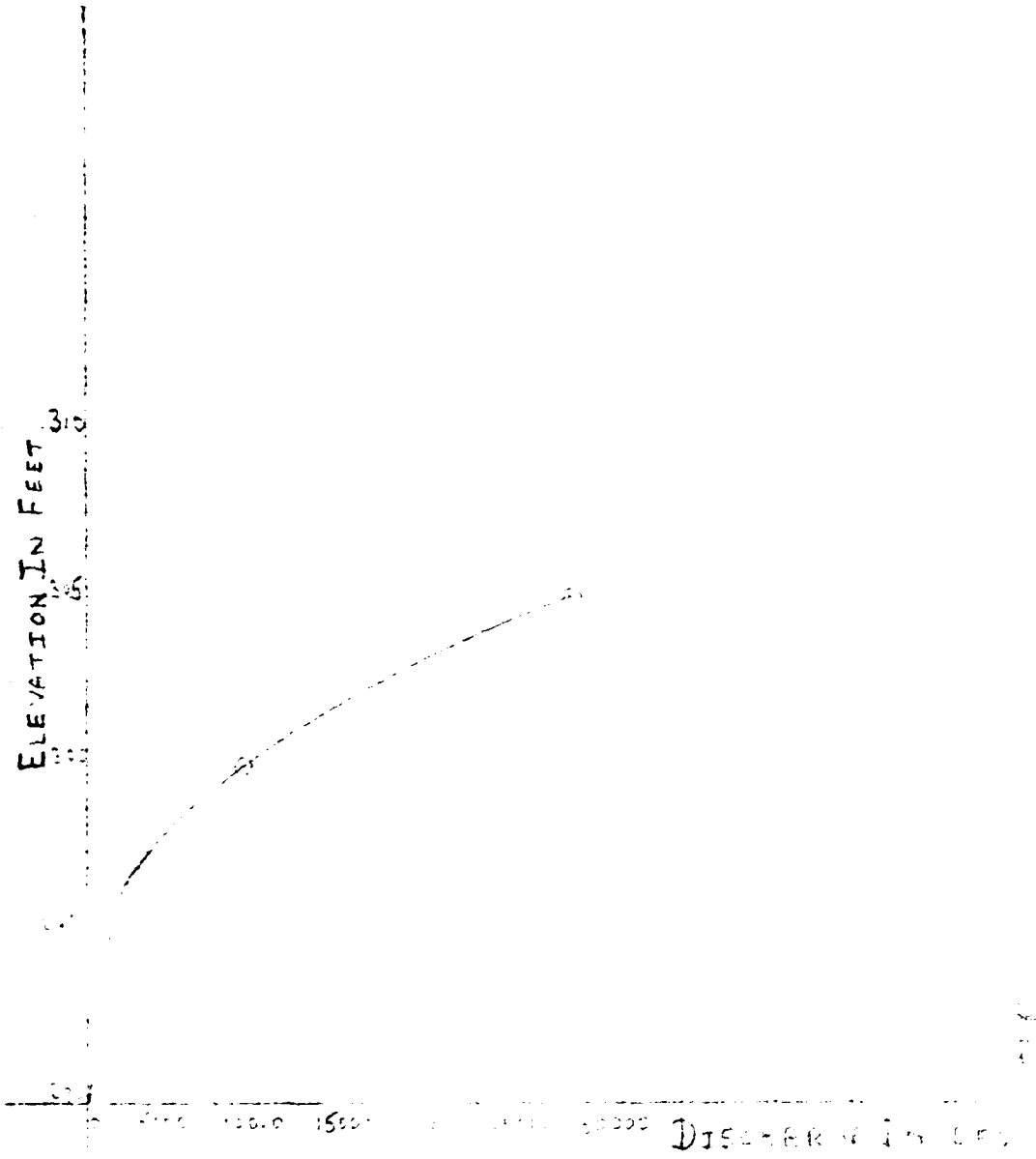
FLOOD DEPTH AT SECTION BB = EL 300.8 − EL [illegible] = [illegible] FT

AND VELOCITY AT SECTION BB = $\frac{11,[illegible]}{2160} \cong$ [illegible] FPS

BETWEEN, SECTION AA AND BB. THE FLOOD DEPTH IS ESTIMATED TO BE 11 ± FT. SINCE THE DOWNSTREAM GROUNDS (e.g., A PLAYGROUND ON THE LEFT BANK) ARE 4 TO 9 FT ABOVE THE RIVER BED, IT IS EXPECTED THAT FLOODING OF THIS AREA BY 2 TO 7 FT OF WATER WILL OCCUR. IN ADDITION THERE IS A POTENTIAL OF FLOOD DAMAGE TO A FEW ADDITIONAL HOMES IN THE VICINITY.


ELEVATION IN FEET
310
305
300
HORIZONTAL DISTANCE IN FEET
LOOKING DOWNSTREAM

SECTION BB


ELEVATION IN FEET

DIVERSIFIED TECHNOLOGIES CORP. CONSULTING ENGINEERS
NORTH HAVEN, CONN.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 80-10-23 SHEET [illegible] OF [illegible]
NEW ENGLAND DIVISION COMPUTED BY [illegible] DATE [illegible]
STERLING POND DAM CHECKED BY E Butler B[illegible] DATE [illegible]

FAILURE HAZARD POTENTIAL

BASED UPON THE FIELD INFORMATION THE LOW SECTION OF THE DAM APPEARS TO BE IN THE VICINITY OF SPILLWAY #2 AND HENCE IT IS PRESUMED THAT FAILURE OF THE DAM WOULD occur IN THIS VICINITY. THE FAILURE ANALYSIS WAS PERFORMED WITH POOL AT TOP OF DAM (EL. 306.5 NGVD).

SUMMARY OF BREACH ANALYSIS RESULTS

LOCATION	DISTANCE FROM DAM FT.	PEAK FLOW RATE CFS	FLOOD STAGE	FLOOD DEPTH FT	VELOCITY FPS
DAM	0	16,150	299.3	5.5	—
A A	150	15,120	304.3	11.3	6.5
B B	800	11,300	300.8	11	5

SECTION AA 150' D/S OF THE DAM IS LOCATED AT THE OUTLET OF THE CULVERT ON CHURCH STREET. THE FLOOD DEPTH AT THIS SECTION IS ESTIMATED TO BE 11.3'. A STORE AND SEVERAL HOMES ARE LOCATED ON THE LEFT BANK OF THE RIVER AT THIS SECTION. THE FIRST FLOOR IS 9± FEET ABOVE THE RIVER BED. THE BASEMENT AND 1ST FLOOR OF THESE HOMES ARE EXPECTED TO BE FLOODED WITH ABOUT 7 FEET OF WATER. IN ADDITION CHURCH STREET (STATE HIGHWAY) WOULD BE SUBMERGED UNDER 7 FEET OF FLOOD WATER, SINCE THE ROAD IS 10± FT ABOVE THE RIVER BED. FURTHER D/S 800 FT. FROM THE DAM, ANALYSIS WAS PERFORMED AT SECTION B'B, WHERE THE FLOOD DEPTH IS ESTIMATED TO BE 11 FT. THERE ARE SEVERAL HOMES IN THE VICINITY

...SECTION ... AND ...
...IE NTE 1/4. SOME OF THESE ...
... A POTENTIAL FOR FAILURE ...
...DITION. A PLAYGROUND LOCATED ...
...LOW SECTION AA AND ... BE
...DED BY 2 TO 3 FT OF WATER.

... A DAM FAILURE ... IN ...
... HOME, CHURCH, SCHOOL AND ... LOCATED
... DIRECTLY TO THE DOWNSTREAM ...
... WITHIN A POSSIBLE ... OF MINUTES THAT
... LIVES. HENCE, A HAZARD POTENTIAL
OF HIGH MAGNITUDE IS CONSIDERED ... LIKELY.

... ROUTING WAS ALSO PERFORMED KEEPING ... AGE
VOLUME (S) CONSTANT. THE RESULTING ... AND
STAGE & DEPTH VALUES OBTAINED ...
THE SAME.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO 80-10-[illegible] SHEET ... OF
NEW ENGLAND DIVISION COMPUTED BY ... DATE ...
STERLING POND DAM CHECKED BY ... DATE ...

SUMMARY- HYDRAULIC/HYDROLOGIC COMPUTATIONS

PERFORMANCE AT PEAK FLOOD CONDITIONS:

PEAK INFLOW (½PMF)	26,400 CFS
PEAK OUTFLOW	25,000 CFS
CAPACITY OF ALL THREE SPILL. TO TOP OF DAM (306.3NGVD)	2,940 CFS
CAP. OF ALL THREE SPILL. TO TOP OF DAM% OF PEAK OUTFLOW	10
CAP. OF ALL THREE SPILL. TO PEAK FLOOD ELVN(310.6NGVD)	10,870 CFS
CAP. OF ALL THREE SPILL. TO PEAK FLOOD ELVN % OF PEAK OUTFLOW	39
CAP. OF PRINCIPAL SPILL. TO TOP OF DAM	905 CFS
CAP. OF PRINCIPAL SPILL. TO TOP OF DAM% OF PEAK OUTFLOW	3
CAP. OF PRINCIPAL SPILL. TO PEAK FLOOD ELVN	3,160 CFS
CAP. OF PRINCIPAL SPILL. TO PEAK FLOOD ELVN % OF PEAK OUTFLOW	11

PERFORMANCE:

MAXIMUM POOL ELVN	310.6NGVD
MAX. SURCHARGE HEIGHT ABOVE PRINCIPAL SPILL.CREST	7.6 FT
NON-OVERFLOW SECTION OF THE DAM (EL.306.3NGVD)OVERTOPPED	4.3 FT

DOWNSTREAM FAILURE CONDITIONS:

PEAK FAILURE OUTFLOW	15,150 CFS
FLOOD DEPTH IMMEDIATELY D/S FROM DAM	5.5 FT
CONDITIONS AT PRIMARY IMPACT AREA: SECTION AA(STREAM BED EL.293)	
ESTIMATED STAGE BEFORE FAILURE WITH 1960 CFS	298.8NGVD
ESTIMATED STAGE AFTER FAILURE WITH 15,120 CFS	304.3NGVD
ESTIMATED RAISE IN STAGE AFTER FAILURE ΔY_1	5.5 FT
CONDITIONS AT SECONDARY IMPACT AREA: SECTION BB (STREAM BED EL.290)	
ESTIMATED STAGE BEFORE FAILURE WITH 2940 CFS	297 NGVD
ESTIMATED STAGE AFTER FAILURE WITH 11,300 CFS	300.[illegible]NGVD
ESTIMATED RAISE IN STAGE AFTER FAILURE ΔY_2	3.[illegible] FT

PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS

New England Division
Corps of Engineers

March 1978

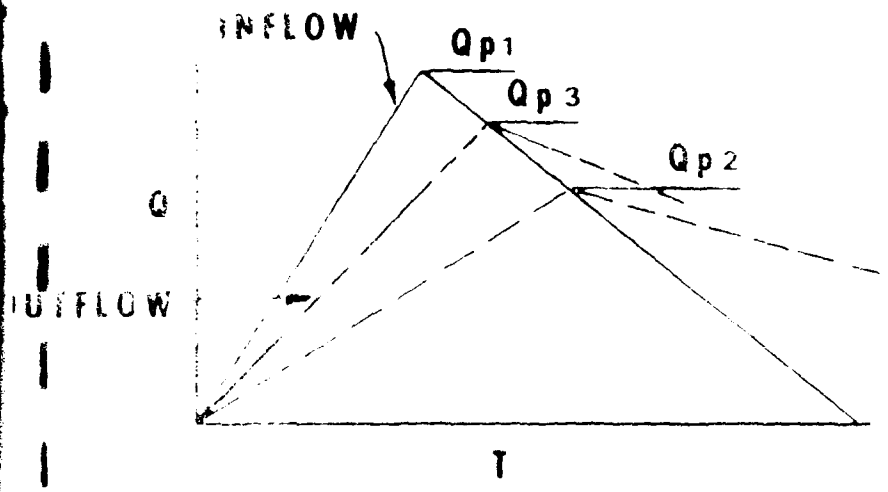
MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

	Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1.	Bull Meadow Brook	26,600	17.2	1,550
2.	West Branch	15,500	9.25	1,675
3.	Thomaston	158,000	97.2	1,625
4.	Southfield Brook	9,000	5.7	1,580
5.	Black Rock	35,000	20.4	1,715
6.	Babcock Brook	20,700	12.0	1,725
7.	Hop Brook	26,400	16.4	1,610
8.	Tully	47,000	50.0	940
9.	Birch Falls	61,000	55.0	1,109
10.	Conant Brook	11,900	7.8	1,525
11.	Fairhaven	160,000	162.0	987
12.	Littleville	98,000	52.3	1,870
13.	Colebrook River	165,000	118.0	1,400
14.	Mad River	30,000	18.2	1,650
15.	Sucker Brook	6,500	3.43	1,895
16.	Union Village	110,000	126.0	873
17.	North Hartland	199,000	220.0	904
18.	North Springfield	157,000	158.0	994
19.	Bell Mountain	190,000	172.0	1,105
20.	Townshend	228,000	106.0(278 total)	820
21.	Sorry Mountain	63,000	100.0	630
22.	Otter Brook	45,000	47.0	957
23.	Birch Hill	88,500	175.0	506
24.	East Brimfield	72,900	67.5	1,080
25.	Westville	38,400	99.5(32 net)	1,200
26.	West Thompson	85,000	175.5(71 net)	1,200
27.	Hodges Village	35,600	51.3	1,040
28.	Barkhamsville	36,500	26.5	1,375
29.	Mansfield Hollow	125,000	159.0	790
30.	West Hill	26,000	28.0	925
31.	Franklin Falls	210,000	1000.0	210
32.	Blackwater	66,500	128.0	520
33.	Hopkinton	135,000	426.0	316
34.	Everett	68,000	64.0	1,062
35.	MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

	River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1.	Pawtuxet River	19,000	200	190
2.	Mill River (R.I.)	8,500	34	500
3.	Peters River (R.I.)	3,200	13	460
4.	Kettle Brook	8,000	30	530
5.	Sudbury River.	11,700	66	350
6.	Indian Brook (Hopk.)	1,000	5.9	340
7.	Charles River.	6,000	184	65
8.	Blackstone River.	43,000	416	200
9.	Quinebaug River	55,000	331	330

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp_1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp_1".

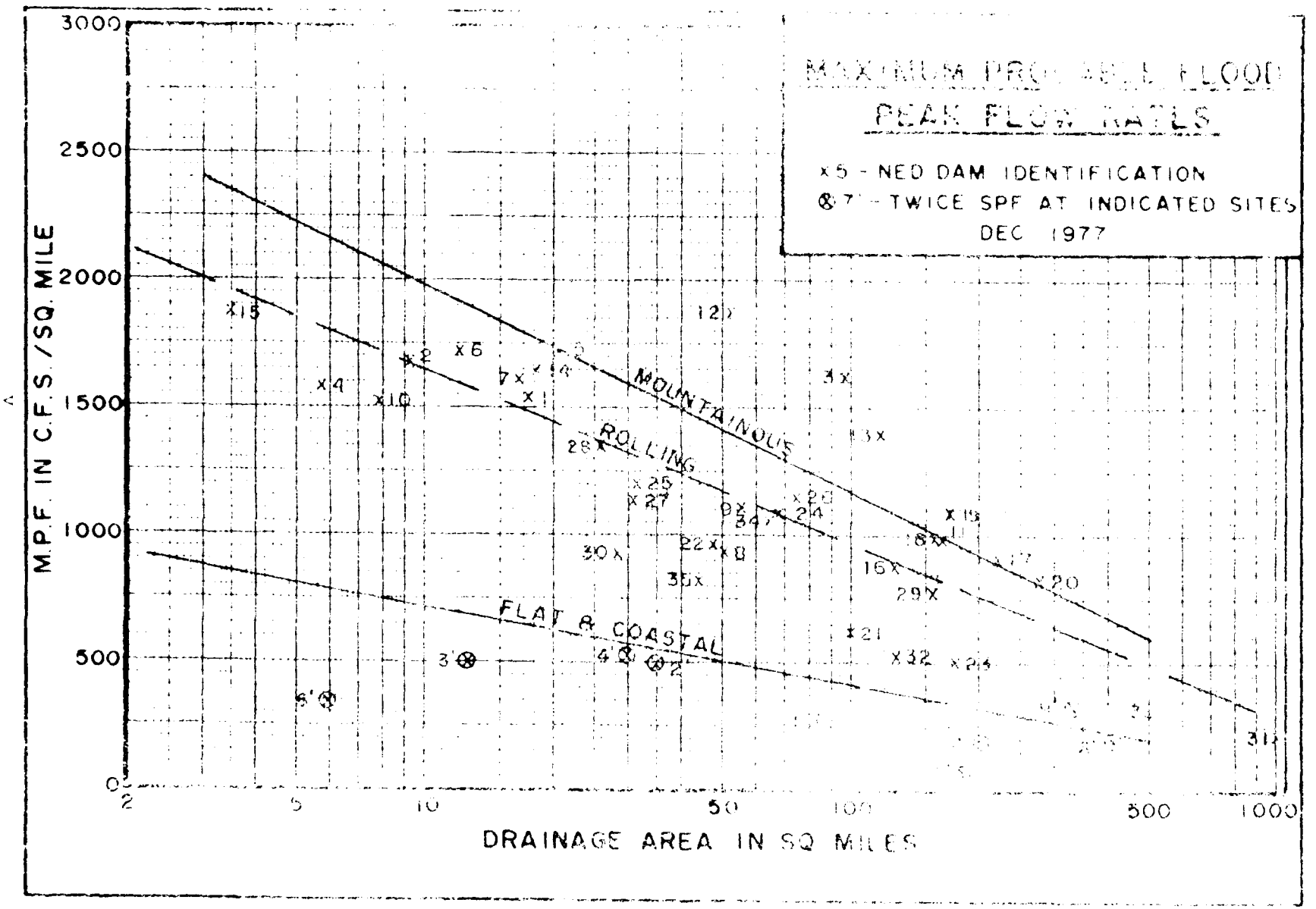
b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore:

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Qp_3".


MAXIMUM PROBABLE FLOOD
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
&7 - TWICE SPF AT INDICATED SITES
DEC 1977
M.P.F. IN C.F.S./SQ. MILE
DRAINAGE AREA IN SQ MILES
MOUNTAINOUS
ROLLING
FLAT & COASTAL
3000
2500
2000
1500
1000
500
0
2
5
10
50
100
500
1000

SURCHARGE STORAGE ROUTING SUPPLEMENT

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Avg "$STOR_1$" and "$STOR_2$" and Compute "Qp_3".

c. If Surcharge Height for Qp_3 and "$STOR_{AVG}$" agree O.K. If Not:

STEP 4: a. Determine Surcharge Height and "$STOR_3$" To Pass "Qp_3"

b. Avg. "Old $STOR_{AVG}$" and "$STOR_3$" and Compute "Qp_4"

c. Surcharge Height for Qp_4 and "New $STOR_{Avg}$" should Agree closely

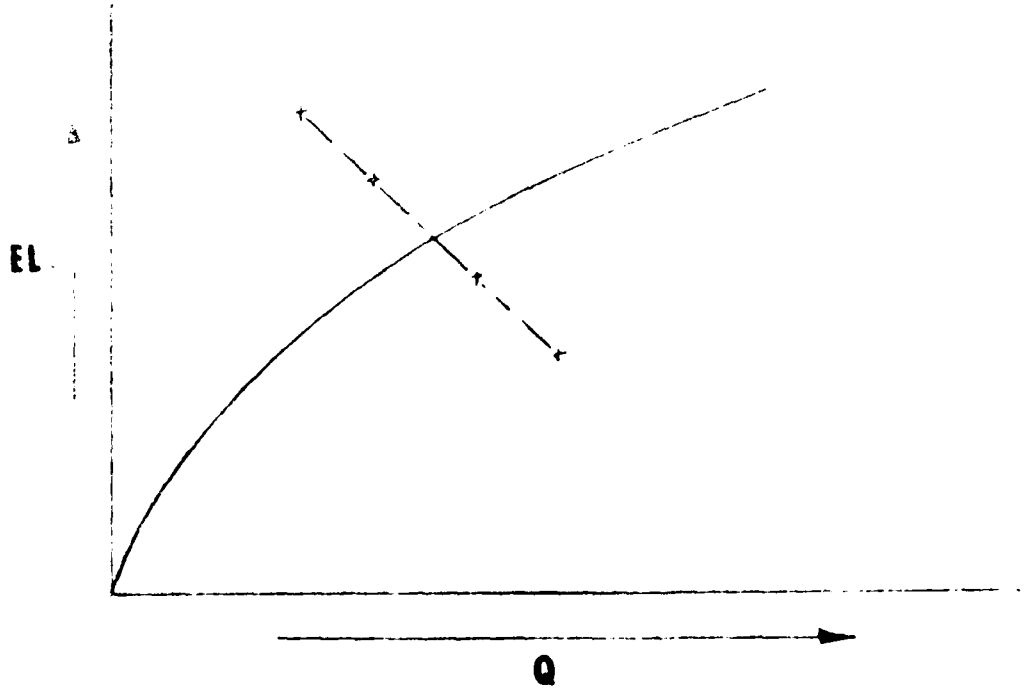
SURCHARGE STORAGE ROUTING ALTERNATE

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR}{19}\right)$$

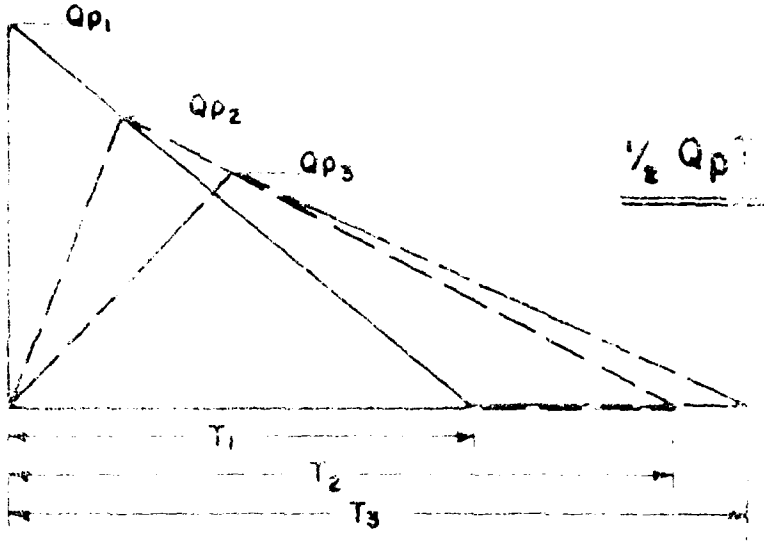
$$Q_{p2} = Q_{p1} - Q_{p1}\left(\frac{STOR}{19}\right)$$

FOR KNOWN Q_{p1} AND 19'' R.O.

Q_{p2}	STOR	EL.
=====	=====	=====



"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



½ Qp1 = 1.2 S

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Qp_1 = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2}$$

W_b = BREACH WIDTH = SMALLEST VALUE NOT GREATER THAN ½ OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING TOPO MAPS AND DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED REACH OF STREAM REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) AT END OF REACH BY ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND CORRESPONDING VOLUME (V_1) IN REACH IN AC-FT. (IF V_1 EXCEEDS ½ OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Qp_2(TRIAL) = Qp_1 (1 - \frac{V_1}{S})$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Qp_2 = Qp_1 (1 - \frac{V_{AVG}}{S})$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME